Nevada Common Raven Management: Journey of Approach and Implementation

Pat Jackson[1], Peter S. Coates[2], Seth Dettenmaier[2], Cali Roth[2], Shawn O'Neil[2]

[1]Nevada Department of Wildlife, [2]US Geological Survey

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5 Take Aways

1. Ravens are an issue
2. Why ravens are an issue
3. Summary of research and tools
4. Summary of Nevada efforts
5. What's next

Thank Collaborators

Corvus corax

- **Wide-spread range (Tropics to Arctic)**

Corvus corax

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- **Omnivorous/generalist**

Corvus corax

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- **Synanthropic**

Corvus corax

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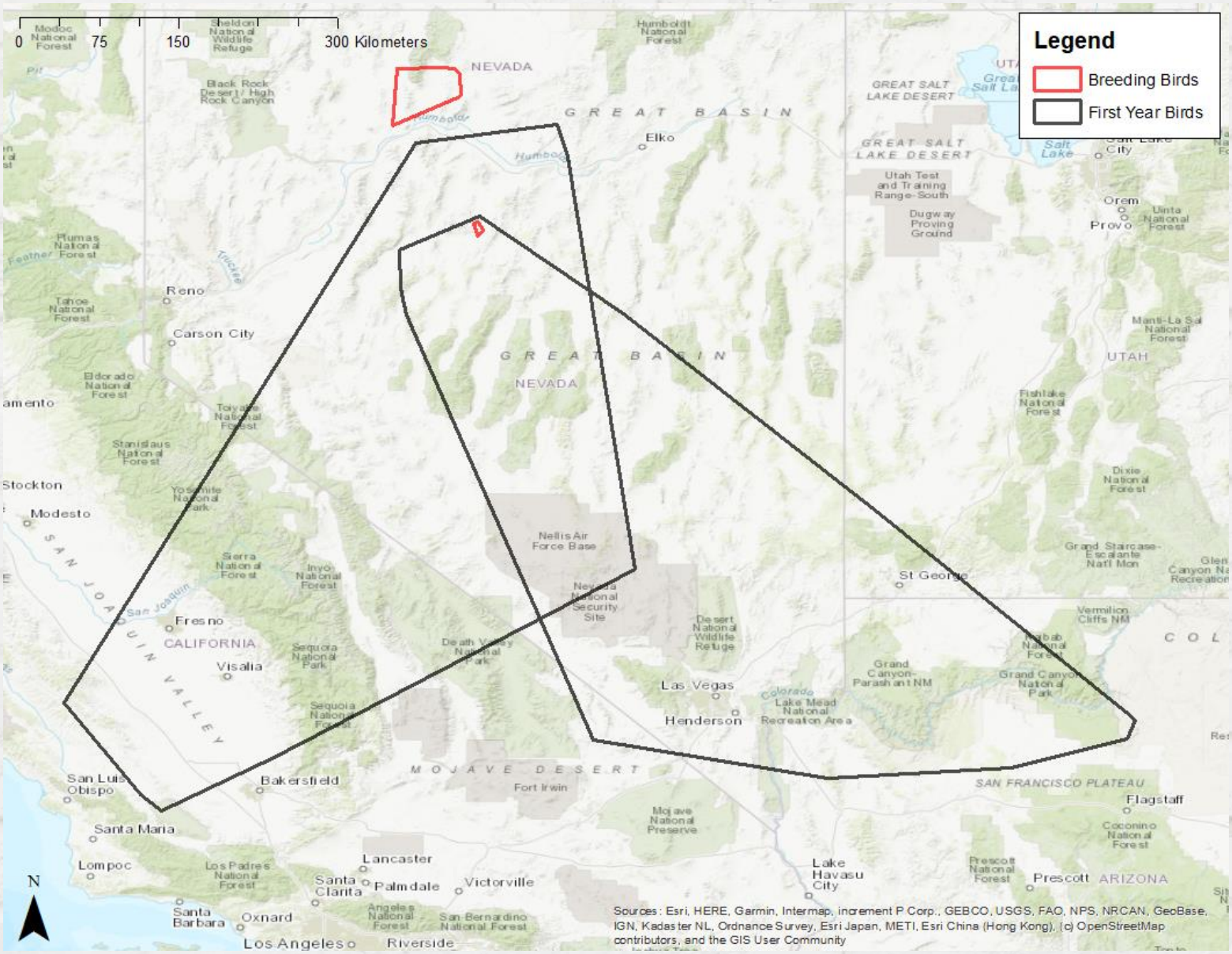
- **Resident and nonresident**


Legend
Breeding Birds
First Year Birds
0 75 150 300 Kilometers
N
NEVADA
GREAT BASIN
GREAT SALT LAKE DESERT
UTAH
CALIFORNIA
SAN JOAQUIN VALLEY
MOJAVE DESERT
SAN FRANCISCO PLATEAU
ARIZONA
Elko
Reno
Carson City
Fresno
Visalia
Bakersfield
Las Vegas
Henderson
St George
Flagstaff
Prescott
Lake Havasu City
Victorville
Palmdale
Lancaster
Santa Barbara
Oxnard
Los Angeles
Riverside
Modesto
Stockton
Provo
Orem
Salt Lake City
Nellis Air Force Base
Fort Irwin
Mojave National Preserve
Desert National Wildlife Refuge
Lake Mead National Recreation Area
Grand Canyon National Park
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Corvus corax

- **Wide-spread range (Tropics to Arctic)**
- **Omnivorous/generalist**
- **Synanthropic**
- **Resident and nonresident**
- **Social and confident**

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Corvus corax

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- **Omnivorous/generalist**
- **Synanthropic**
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- **Social and confident**
- **Intelligent**
- **Long lived**

Overview

Expansion of raven distribution and abundance

↓

Anthropogenic resource subsidies

↓

Predation effects on sensitive species

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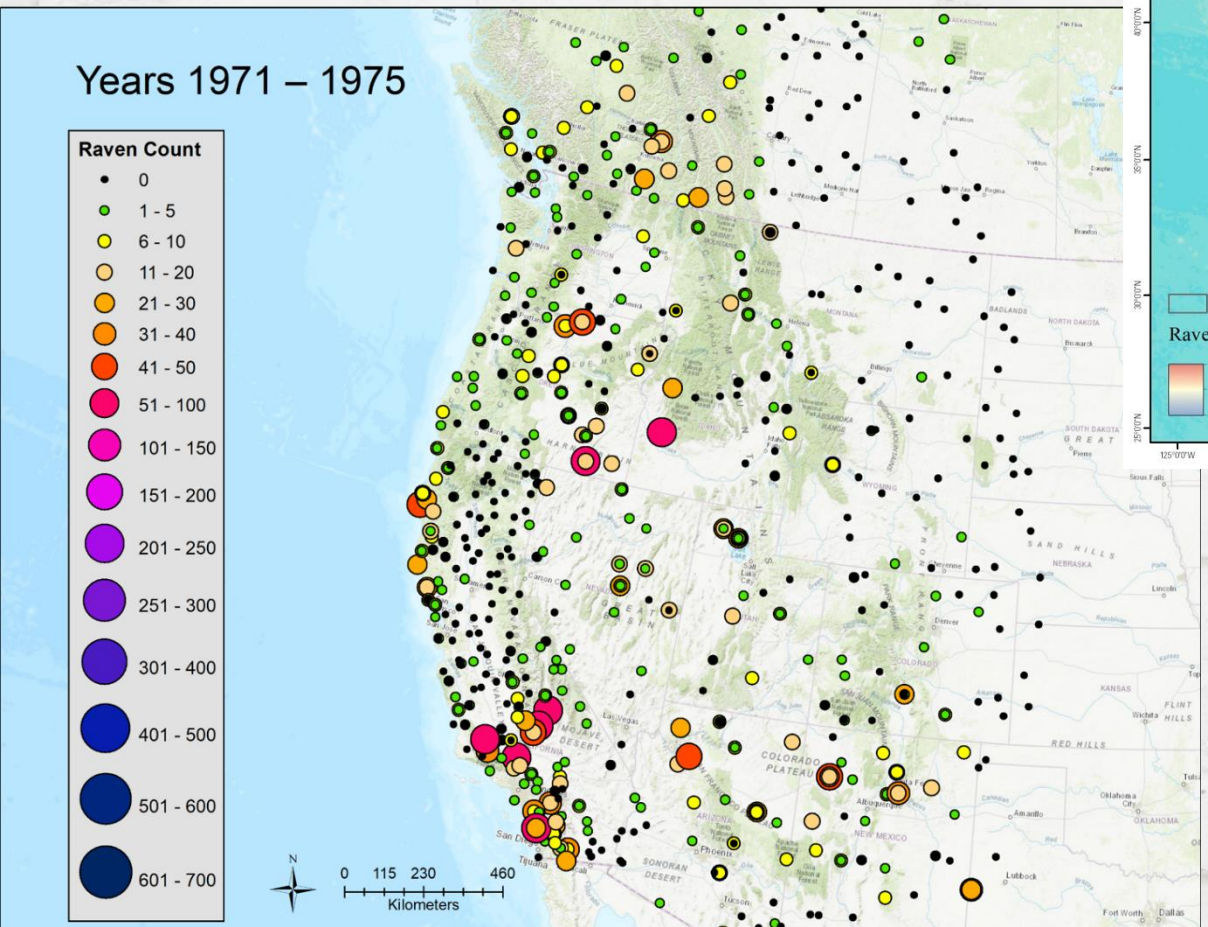
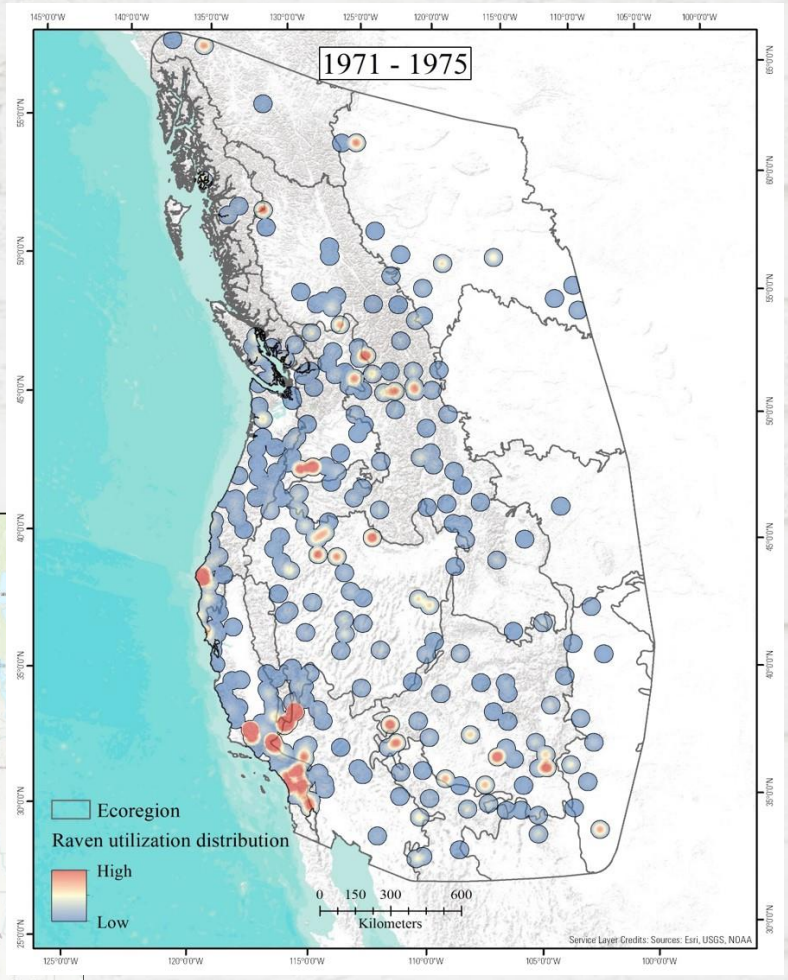
Breeding Bird Survey Data

- Survey Counts
- Utilization Distribution





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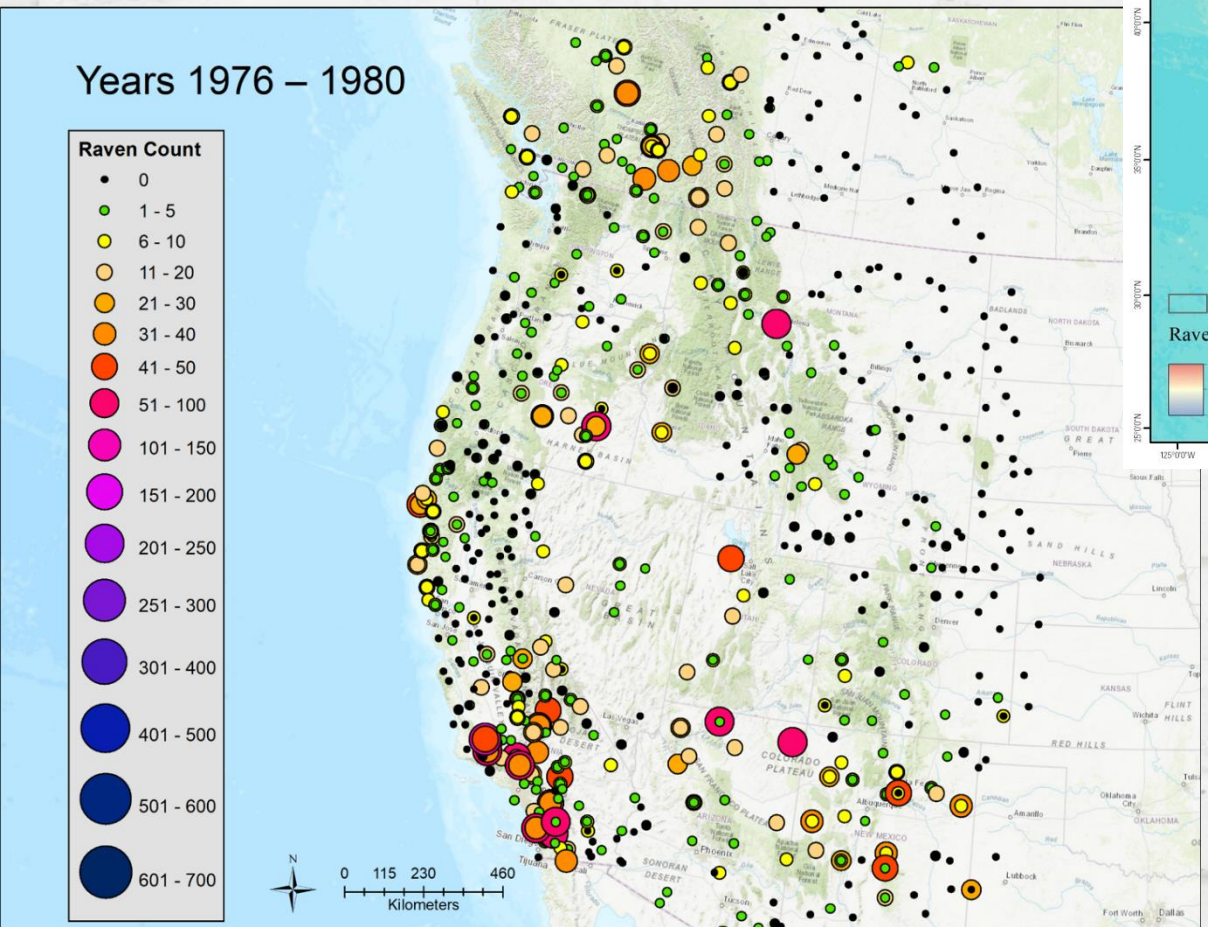

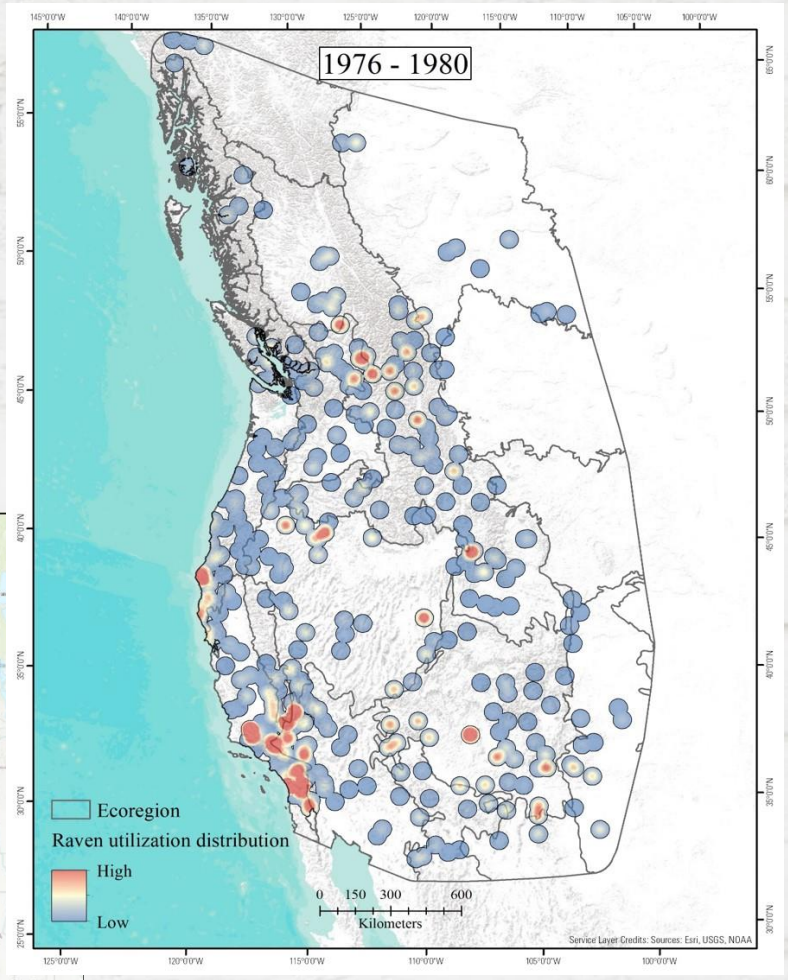

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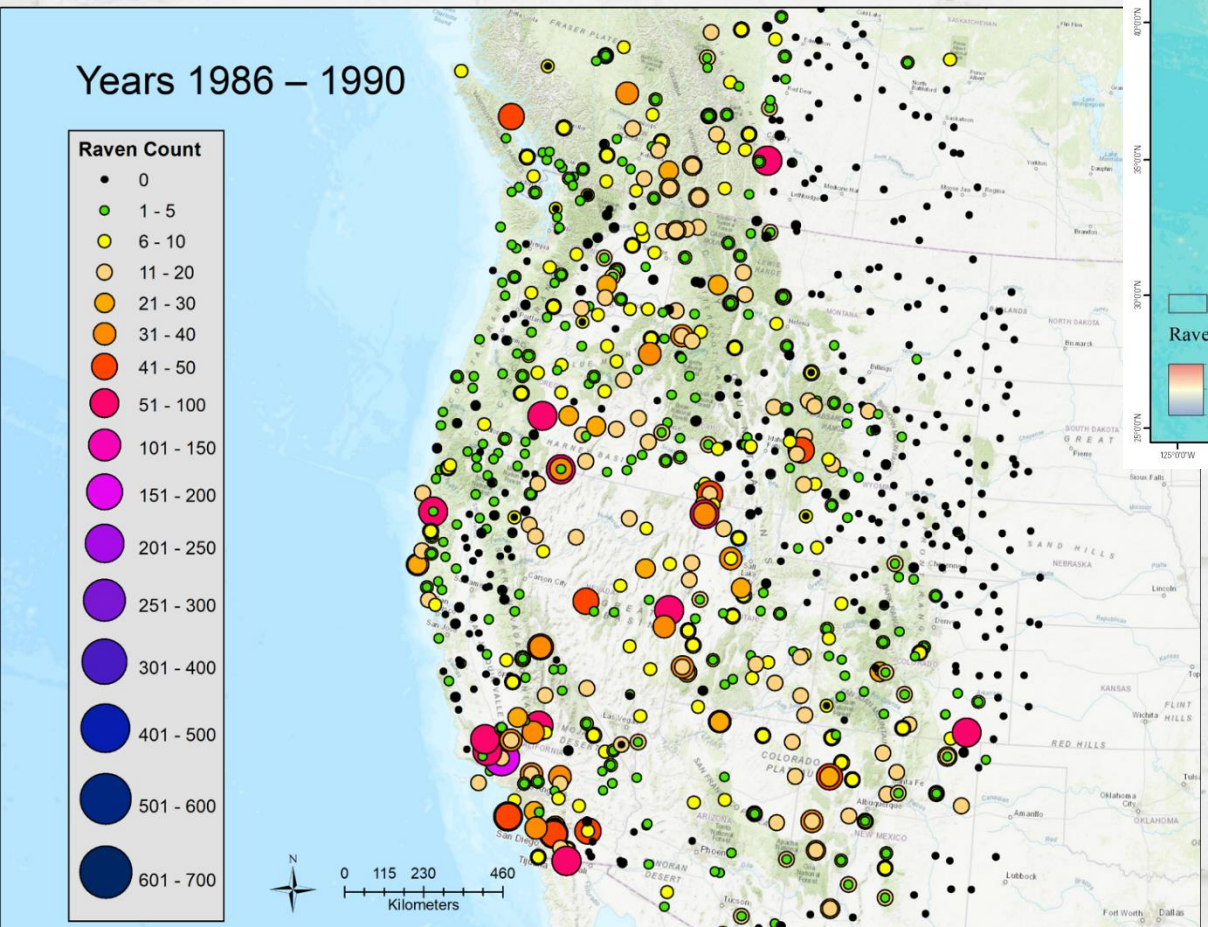

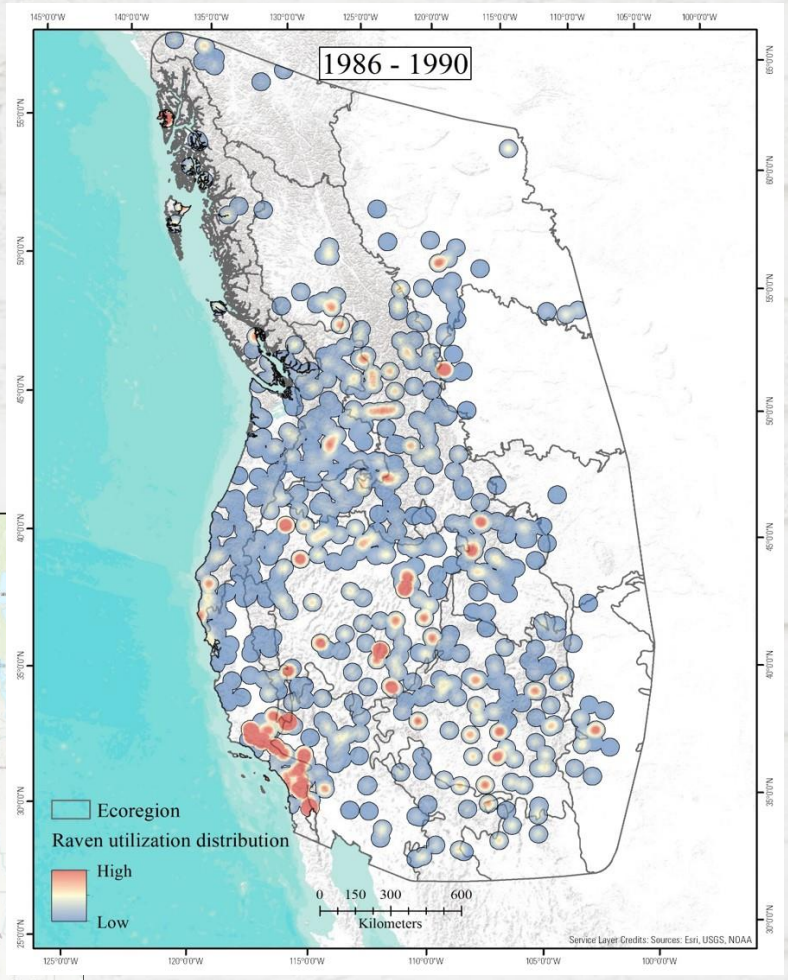

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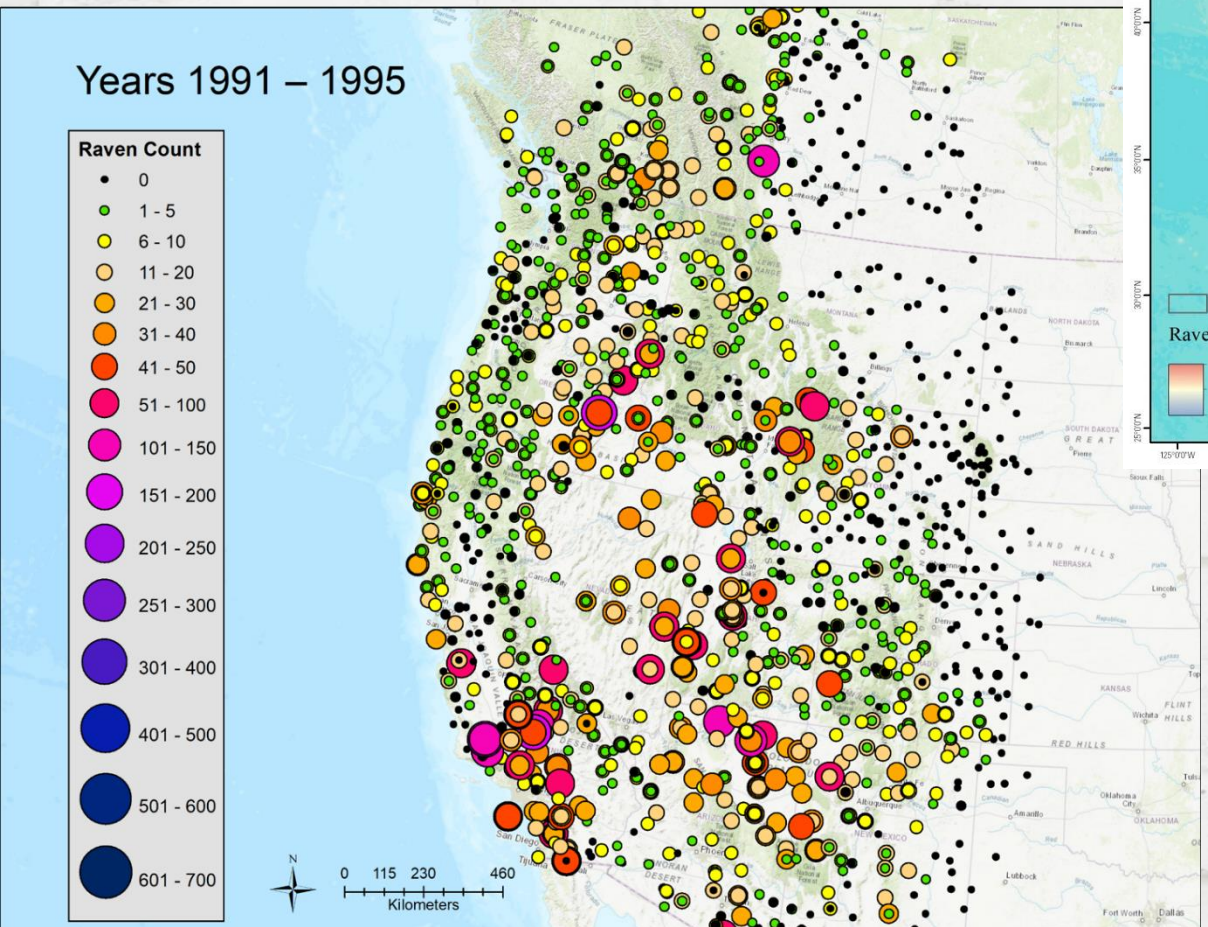

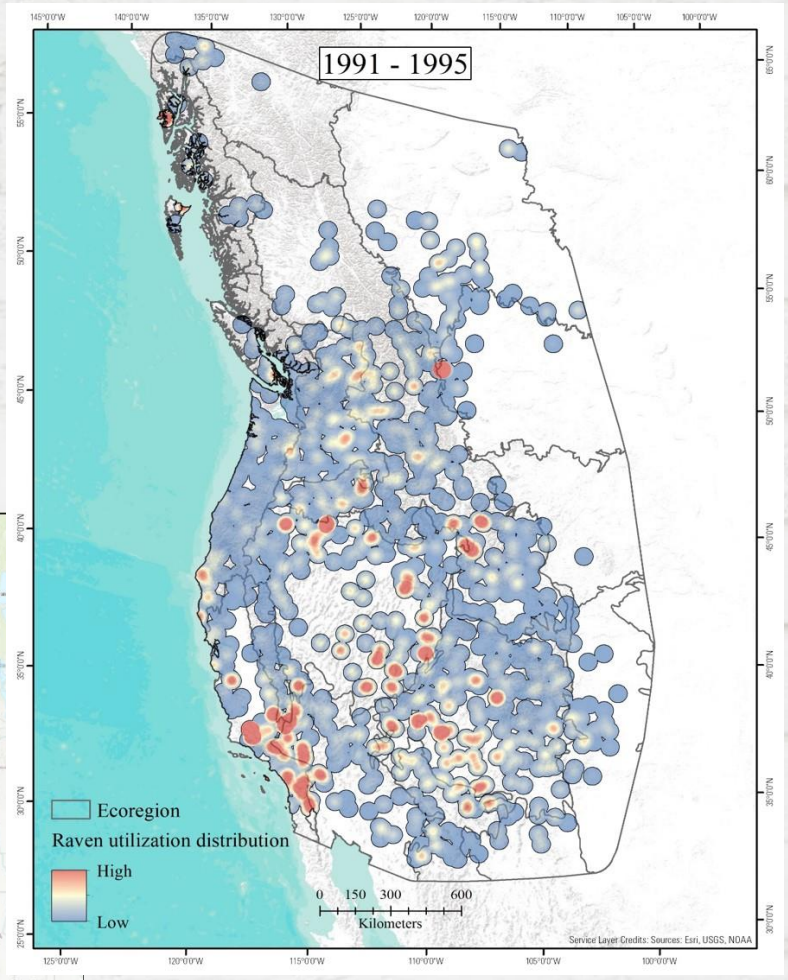

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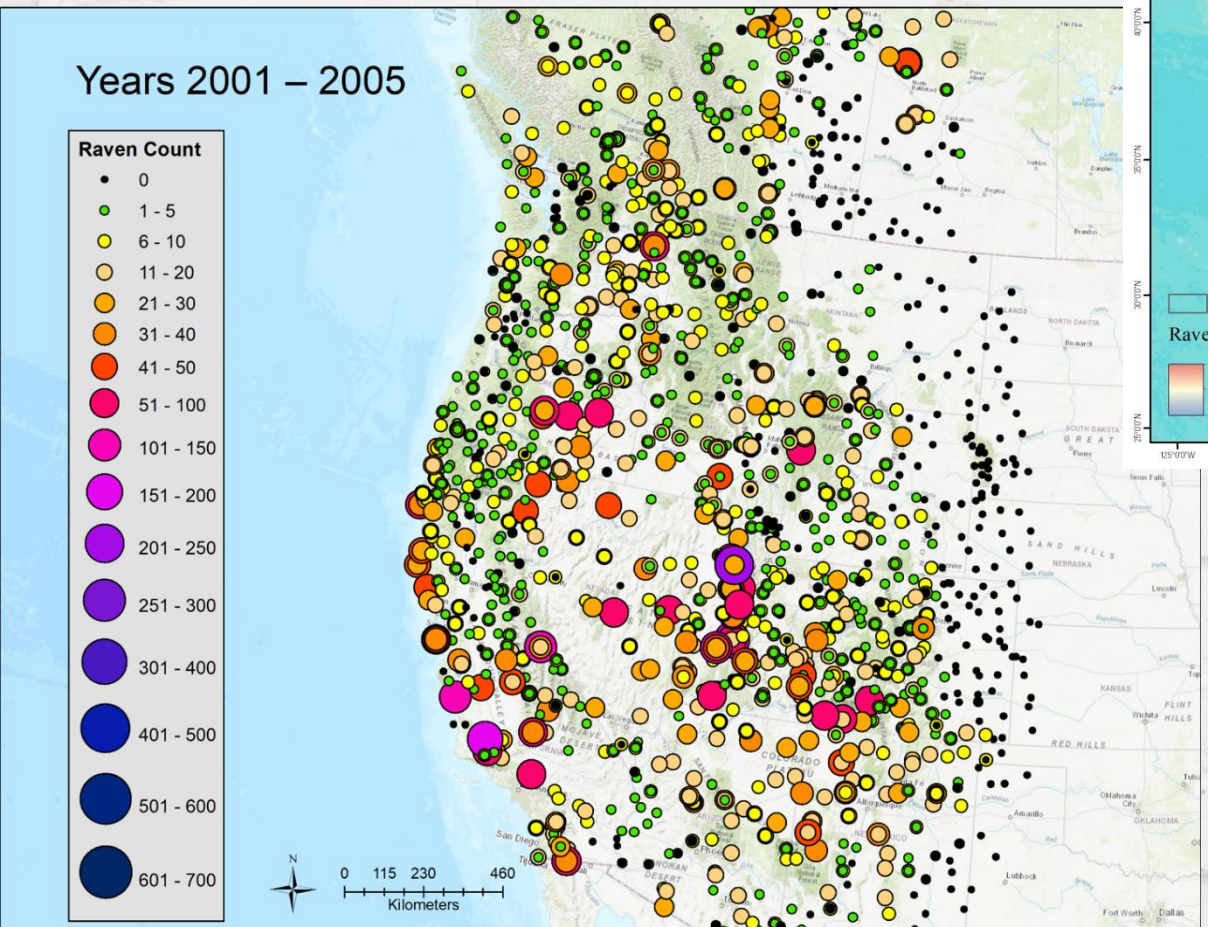

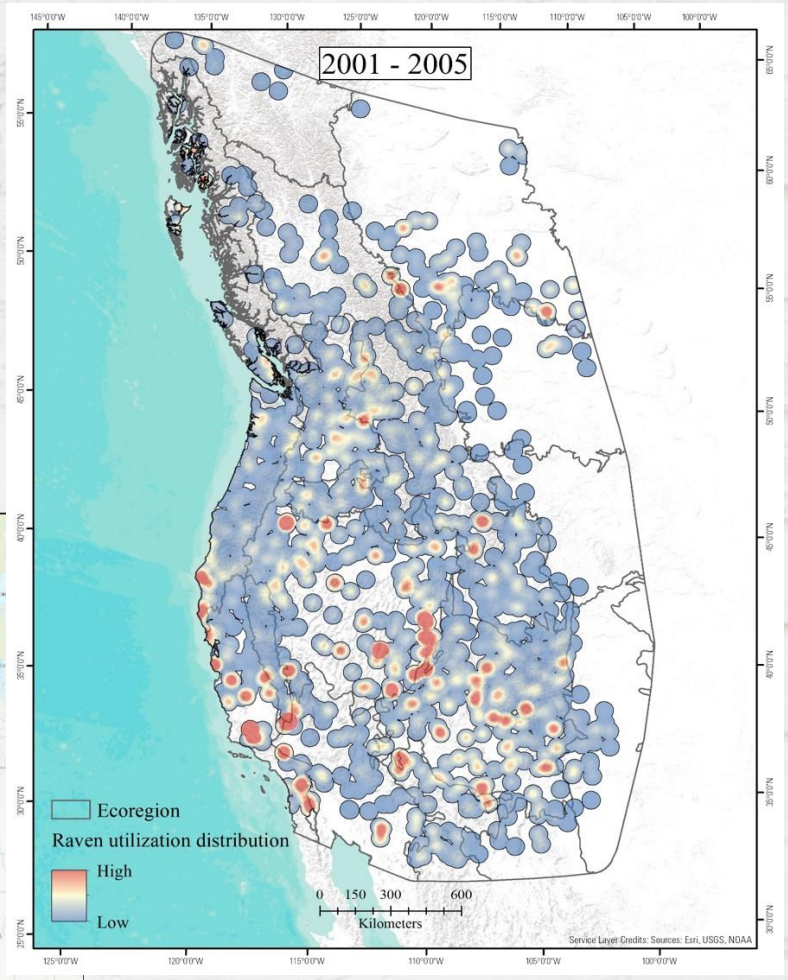

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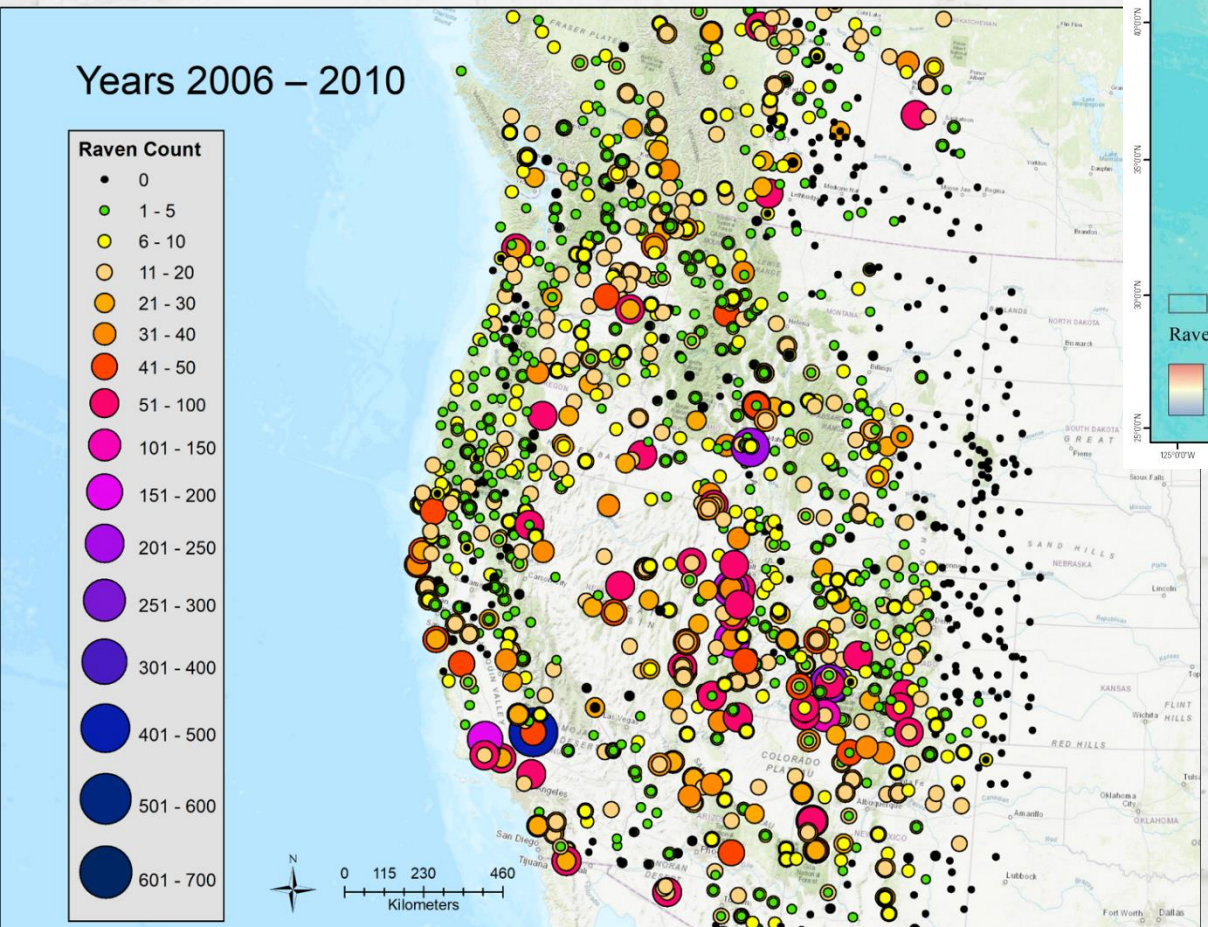

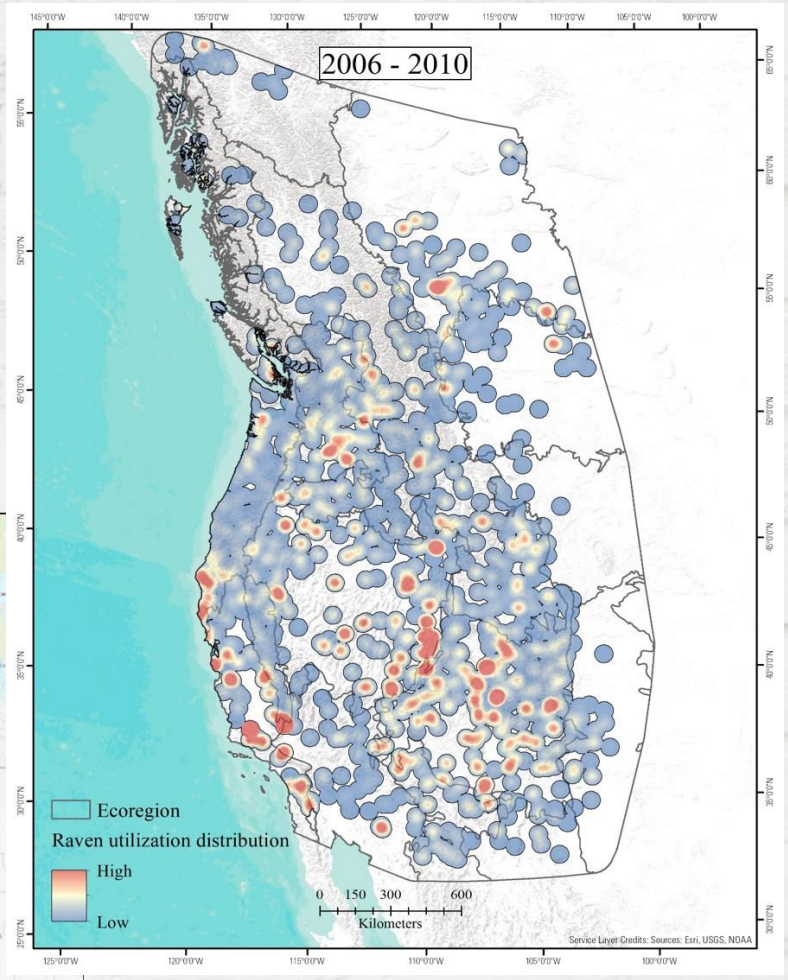

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Breeding Bird Survey Data

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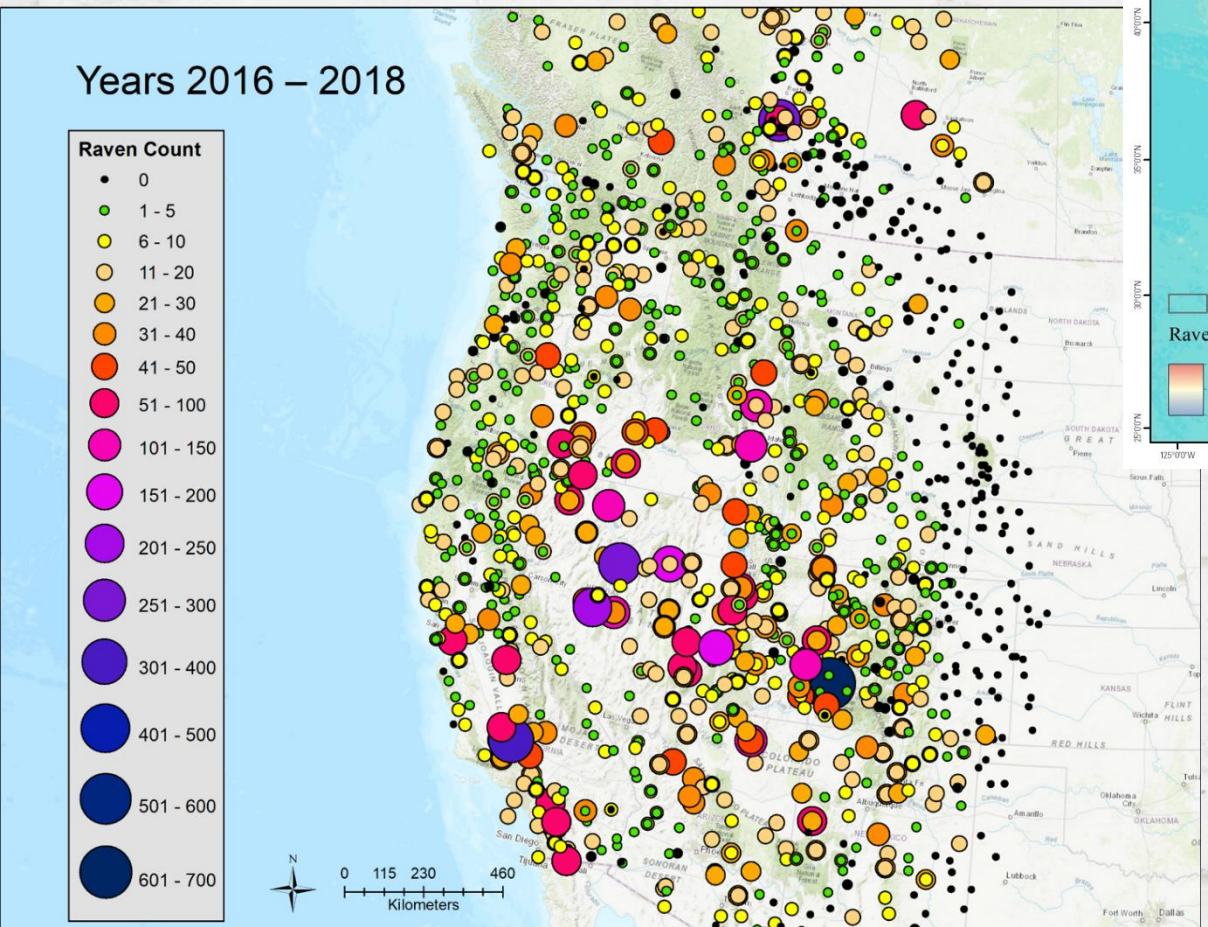
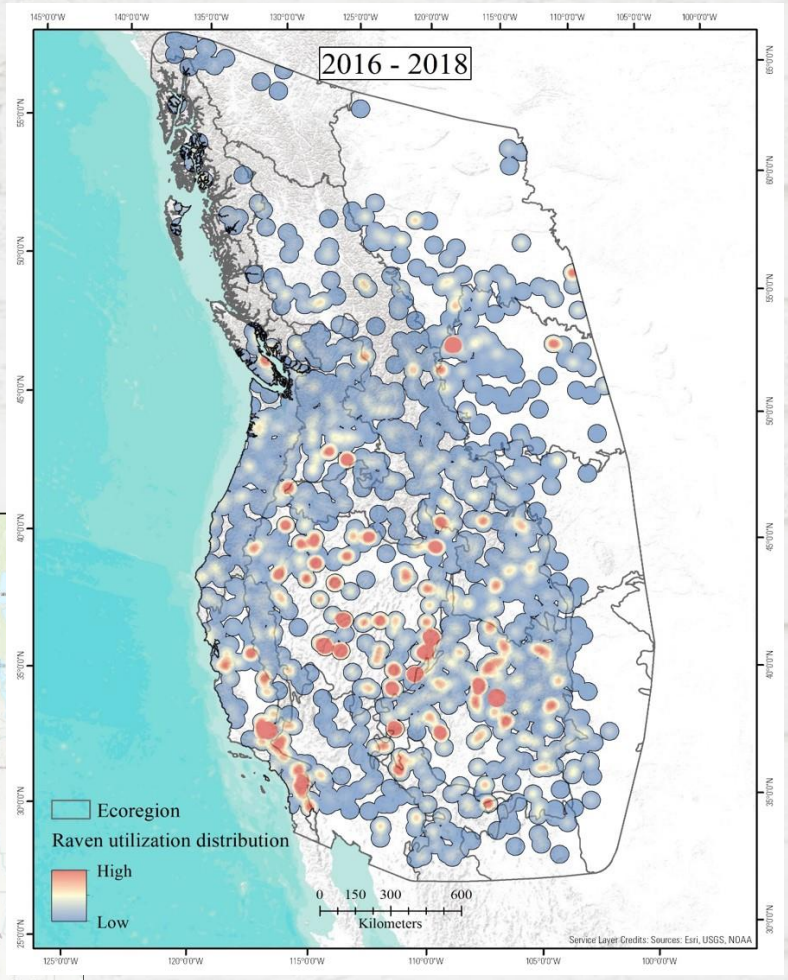
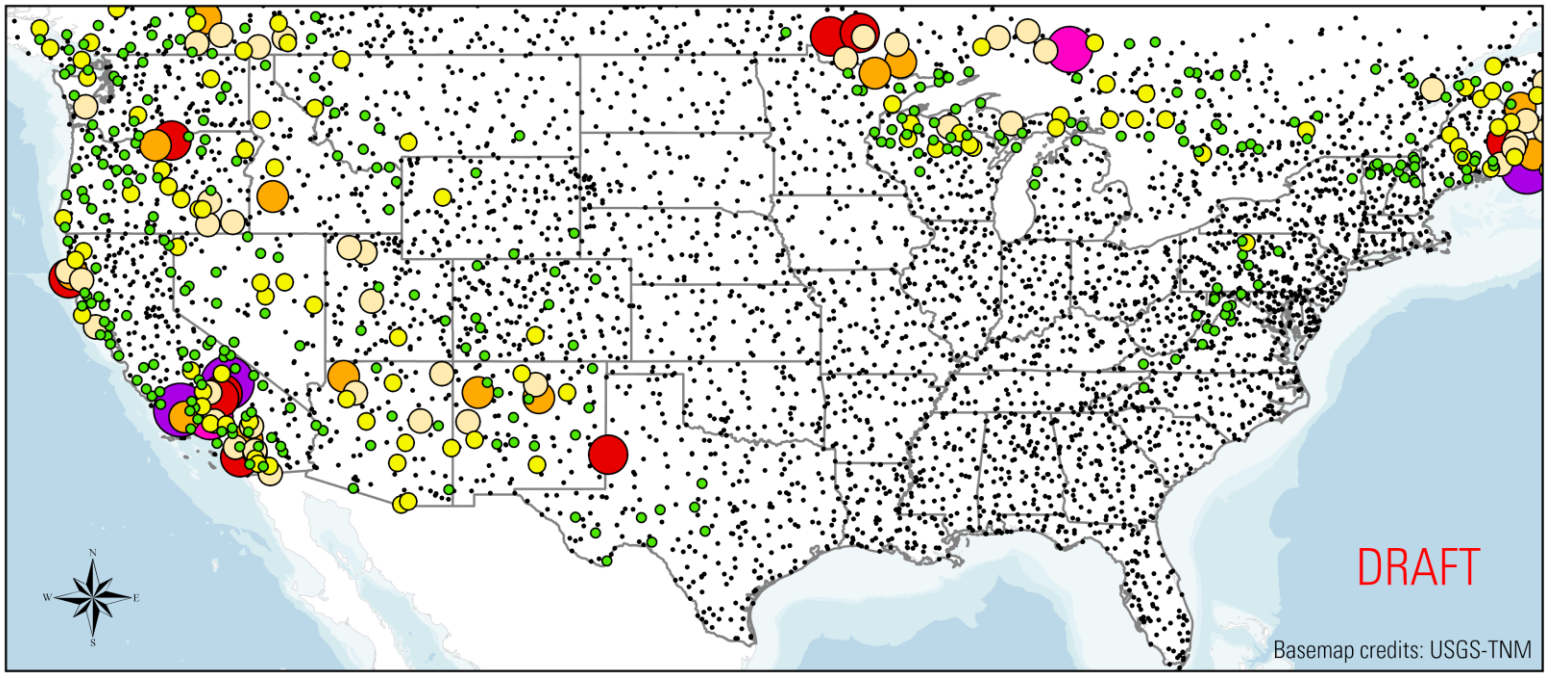






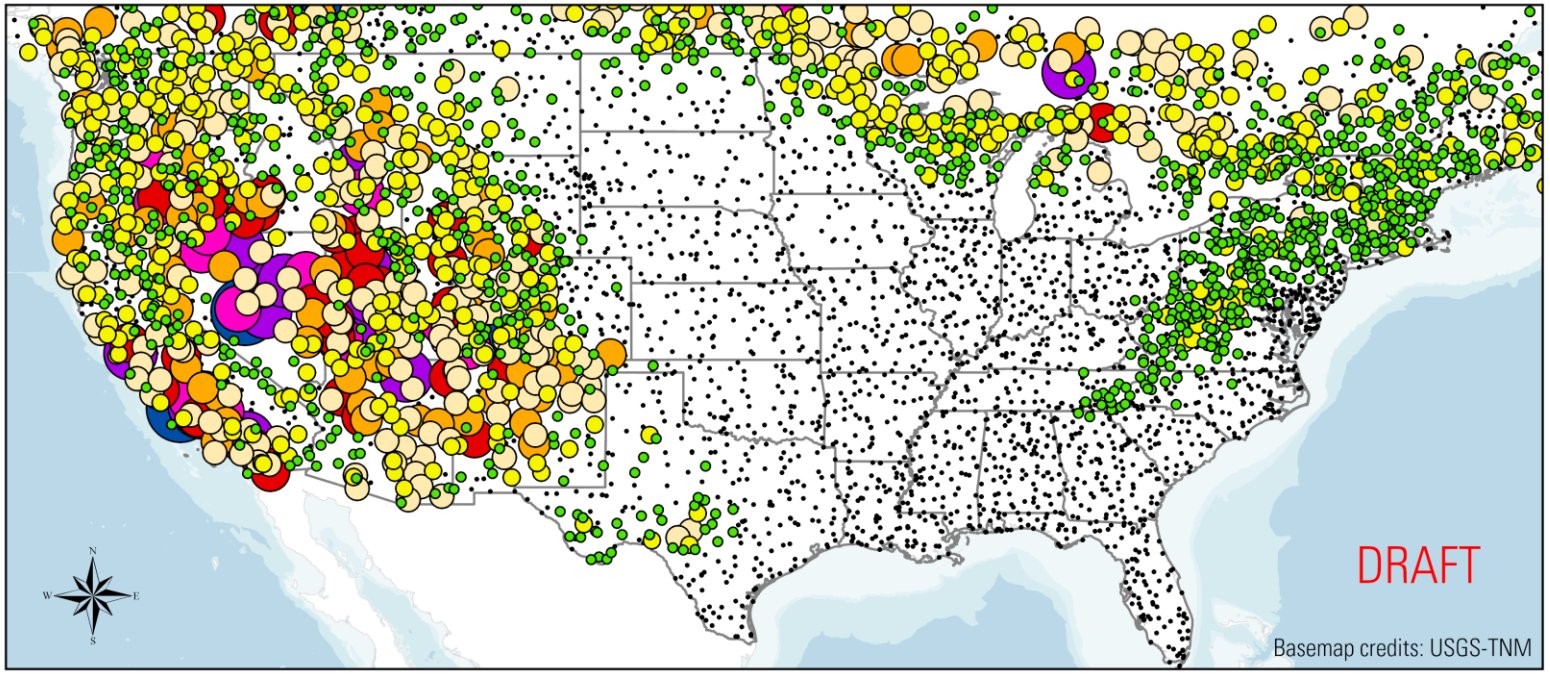
1971 - 1975

- BBS route

Average raven count

- > 0 - 5
- > 5 - 10
- > 10 - 20
- > 20 - 30
- > 30 - 40
- > 40 - 50
- > 50 - 100
- > 100

0 100 200 300 400 500 mi
0 200 400 600 800 1,000 km



2017 - 2022

(no observations in 2020)

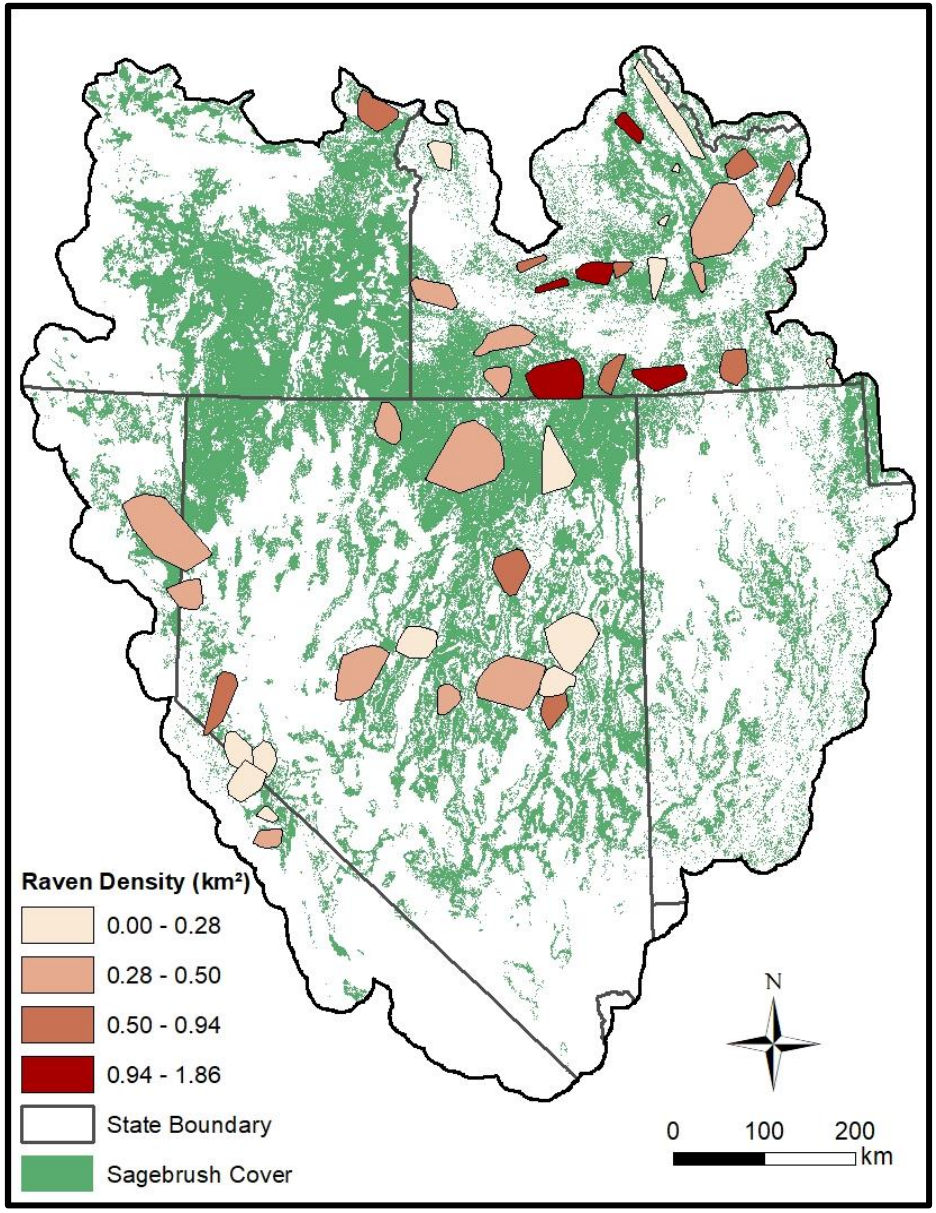
- BBS route

Average raven count

- > 0 - 5
- > 5 - 10
- > 10 - 20
- > 20 - 30
- > 30 - 40
- > 40 - 50
- > 50 - 100
- > 100

0 100 200 300 400 500 mi
0 200 400 600 800 1,000 km

Modeling raven density



ELSEVIER

Biological Conservation
Volume 243, March 2020, 108409

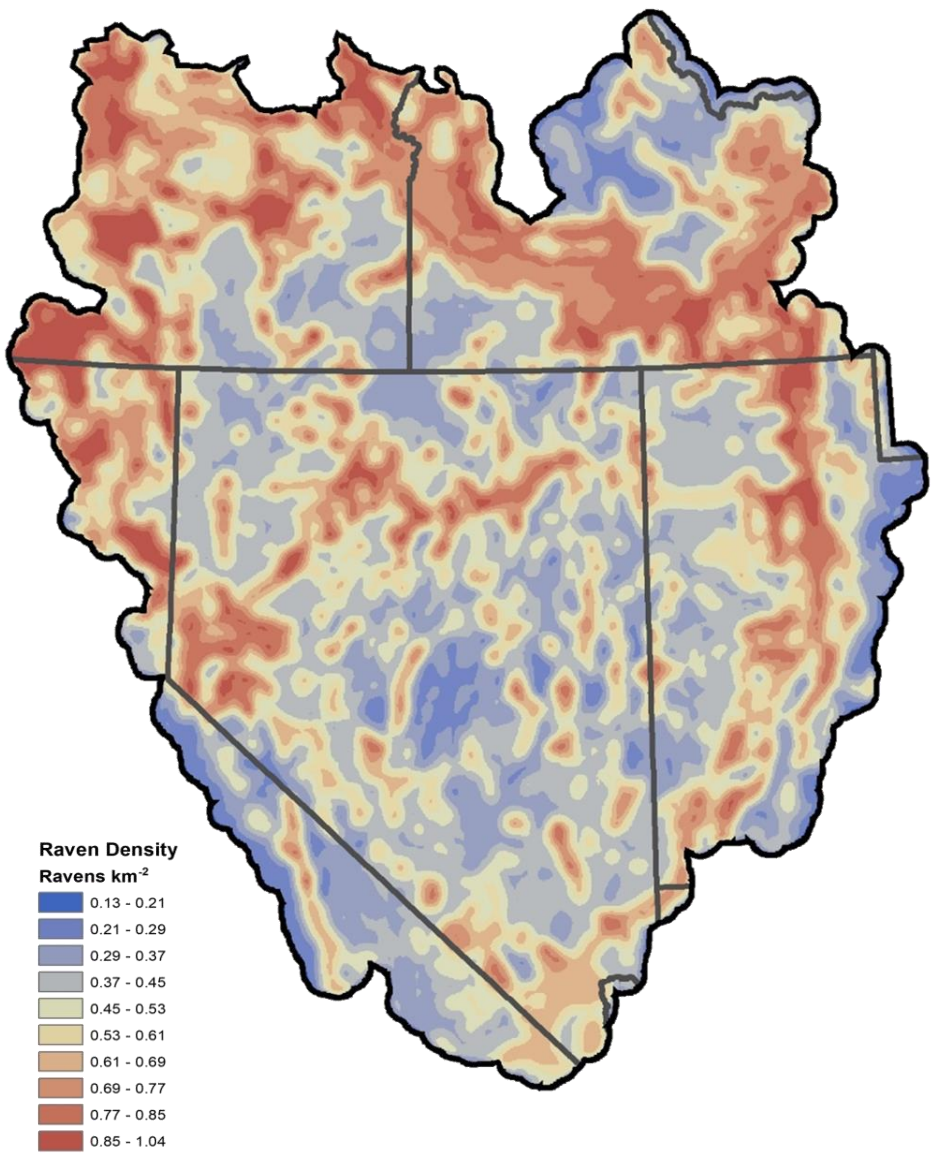
Broad-scale impacts of an invasive native predator on a sensitive native prey species within the shifting avian community of the North American Great Basin

Peter S. Coates [a], Shawn T. O'Neil [a], Brianne E. Brussee [a], Mark A. Ricca [a], Pat J. Jackson [b], Jonathan B. Dinkins [c], Kristy B. Howe [d], Ann M. Moser [e], Lee J. Foster [f], David J. Delehanty [g]

Modeled density of ravens in relation to environmental covariates

- ~15,000 raven surveys at nearly 50 study sites

Modeling raven density



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Average raven density

0.54 ravens km^2 (95% CI = 0.42–0.70)

Total abundance Great Basin

403,346 (95% CI = 310,783–522,803)

Total abundance sagebrush

165,186 (136,874–201,581)

Overview

Expansion of raven distribution and abundance

↓

Anthropogenic resource subsidies

↓

Predation effects on sensitive species

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William Boarman, USGS, 2003


USGS
science for a changing world

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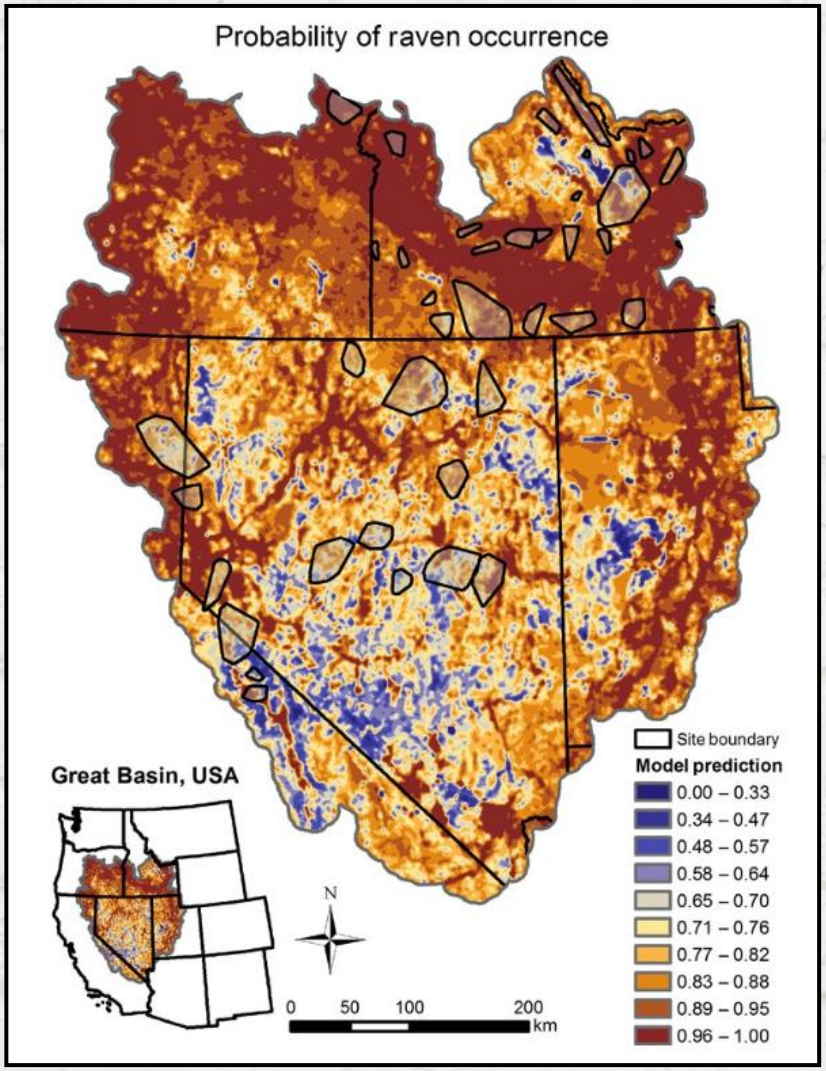
science for a changing world


USGS
science for a changing world
T. Gettelma

Anthropogenic subsidies and Occupancy



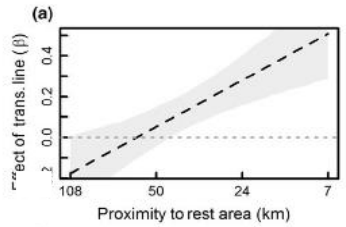
RESEARCH ARTICLE

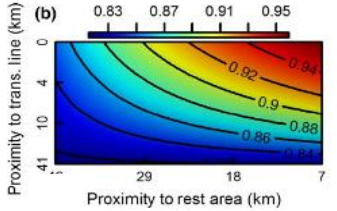
Journal of Applied Ecology

Broad-scale occurrence of a subsidized avian predator: Reducing impacts of ravens on sage-grouse and other sensitive prey

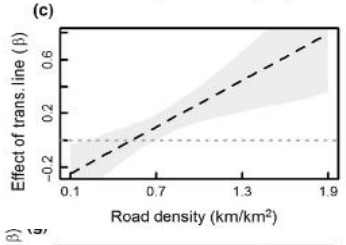
Shawn T. O'Neil[1] | Peter S. Coates[1] | Brianne E. Brussee[1] | Pat J. Jackson[2] | Kristy B. Howe[3] | Ann M. Moser[4] | Lee J. Foster[5] | David J. Delehanty[6]

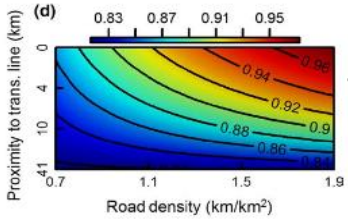
[1]U.S. Geological Survey, Western Ecological Research Center, Dixon, California; [2]Nevada Department of Wildlife, Reno, Nevada; [3]Nevada Natural Heritage Program, Carson City, Nevada; [4]Idaho Department of Fish and Game, Boise, Idaho; [5]Oregon Department of Fish and Wildlife, Hines, Oregon and [6]Department of Biological Sciences, Idaho State University, Pocatello, Idaho



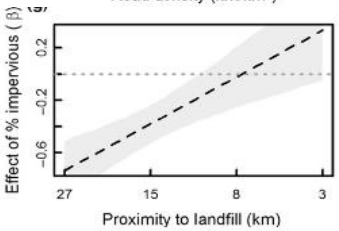


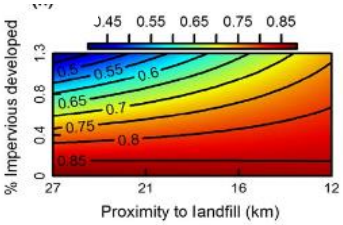
Transmission line Rest area





Transmission line Road density





Imperviousness Landfills

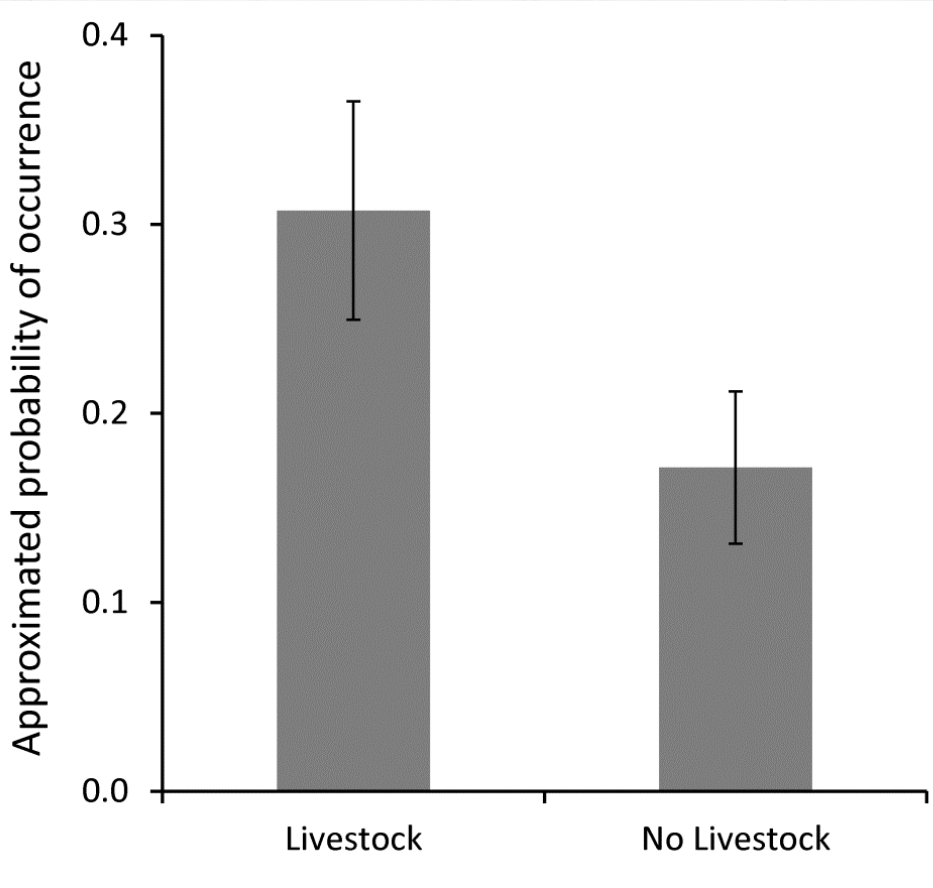
Lessons from Research

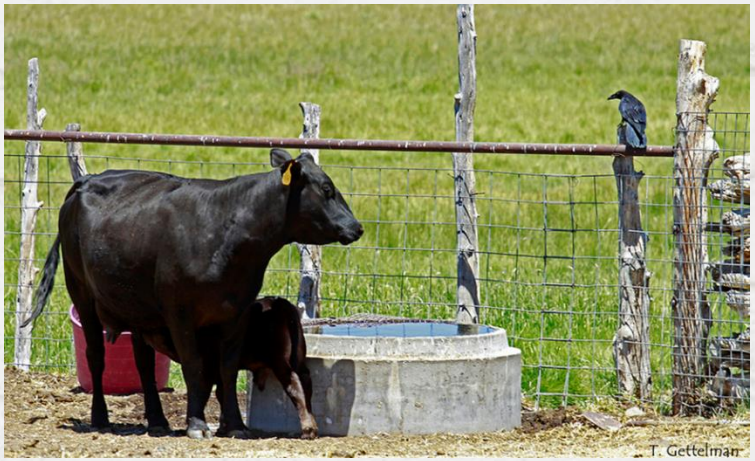
esa

ECOSPHERE

Landscape characteristics and livestock presence influence common ravens: relevance to greater sage-grouse conservation

Peter S. Coates,[1,†] Brianne E. Brussee,[1] Kristy B. Howe,[1,2]
Kit Benjamin Gustafson,[1] Michael L.Casazza,[1] and David J. Delehanty[2]





Odds of raven occurrence increased 45.8% in areas where livestock were present

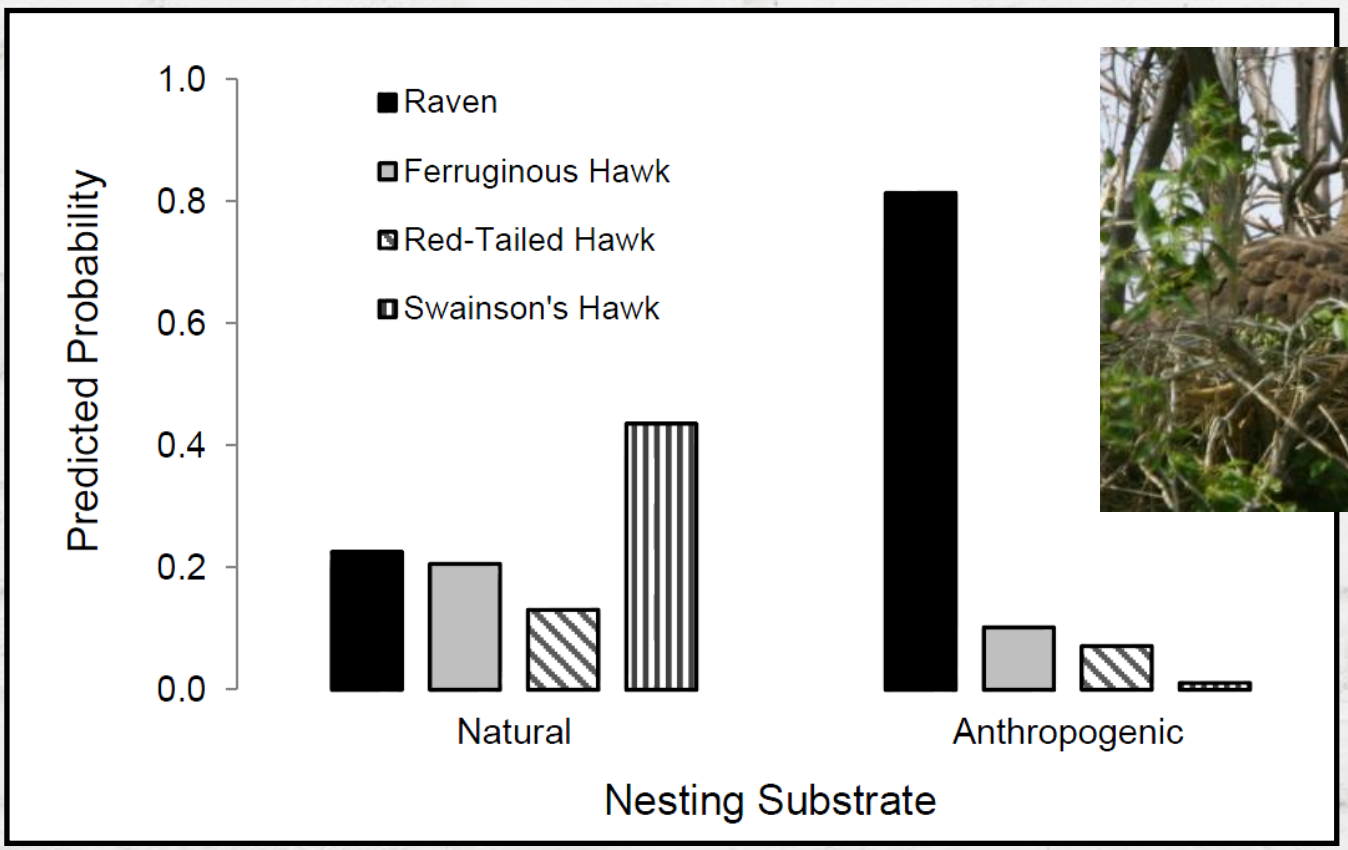
Nesting ravens select powerlines

THE CONDOR
Ornithological Applications
www.cooper.org
Volume 116, 2014, pp. 341–356
DOI: 10.1650/CONDOR-13-126.1

RESEARCH ARTICLE

Landscape alterations influence differential habitat use of nesting buteos and ravens within sagebrush ecosystem: Implications for transmission line development

Peter S. Coates,[1]* Kristy B. Howe,[1,2,3] Michael L. Casazza,[1] and David J. Delehanty[3]



Overview

Expansion of raven distribution and abundance

↓

Anthropogenic resource subsidies

↓

Predation effects on sensitive species

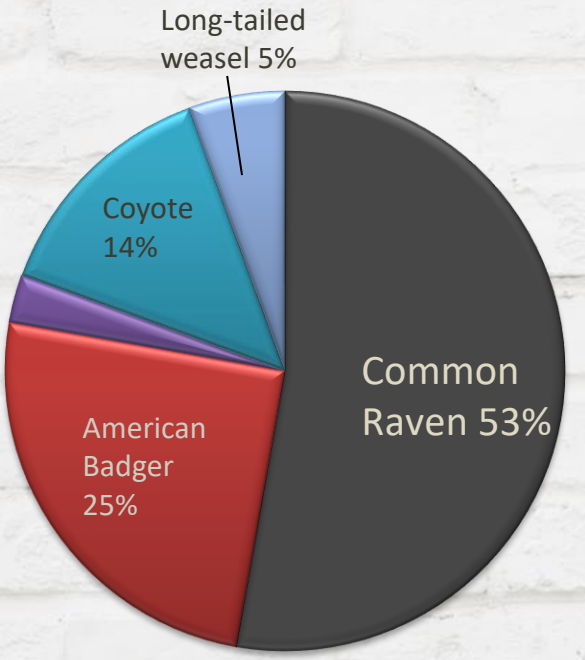
Ravens as effective sage-grouse egg predator

Journal of Wildlife Management 74(2):240–248; 2010; DOI: 10.2193/2009-047

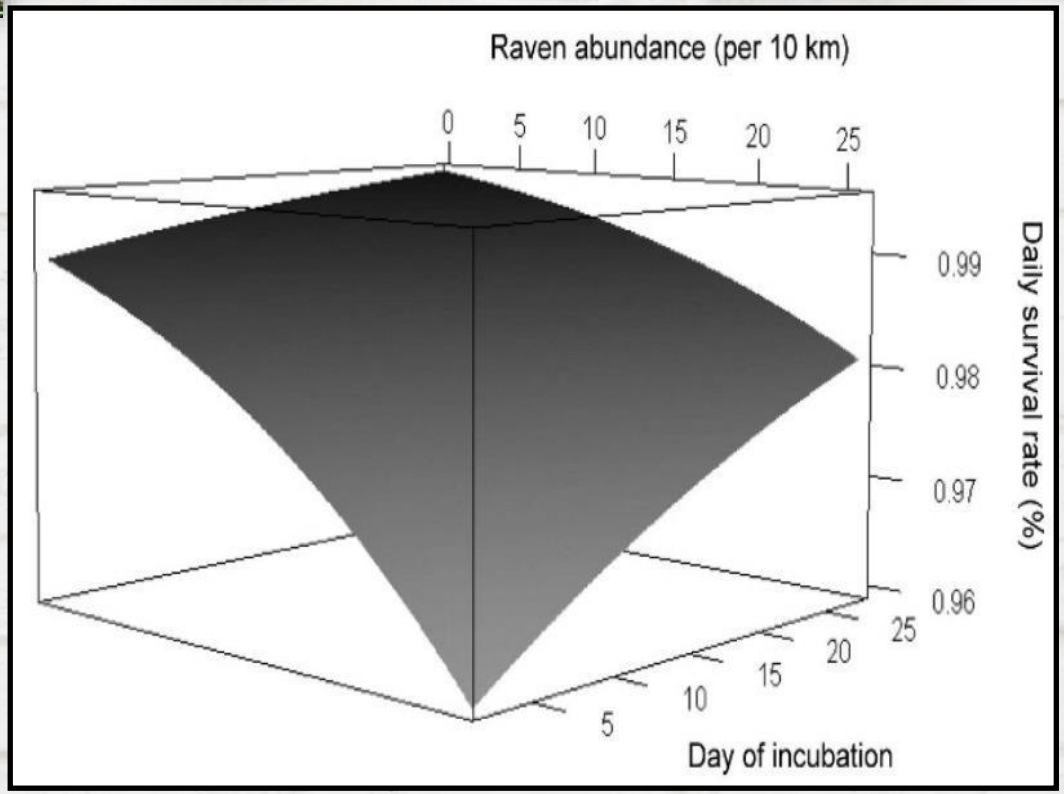
Management and Conservation Article

Nest Predation of Greater Sage-Grouse in Relation to Microhabitat Factors and Predators

PETER S. COATES,[1] *Department of Biological Sciences, Idaho State University, Pocatello, ID 83209-8007, USA*
DAVID J. DELEHANTY, *Department of Biological Sciences, Idaho State University, Pocatello, ID 83209-8007, USA*



Predation on sage-grouse nests (9 years of video data; Idaho State University)



Coates and Delehanty (2010). Journal of Wildlife Management 74:240–248.

Ecological threshold of 0.4 ravens km^{-2}

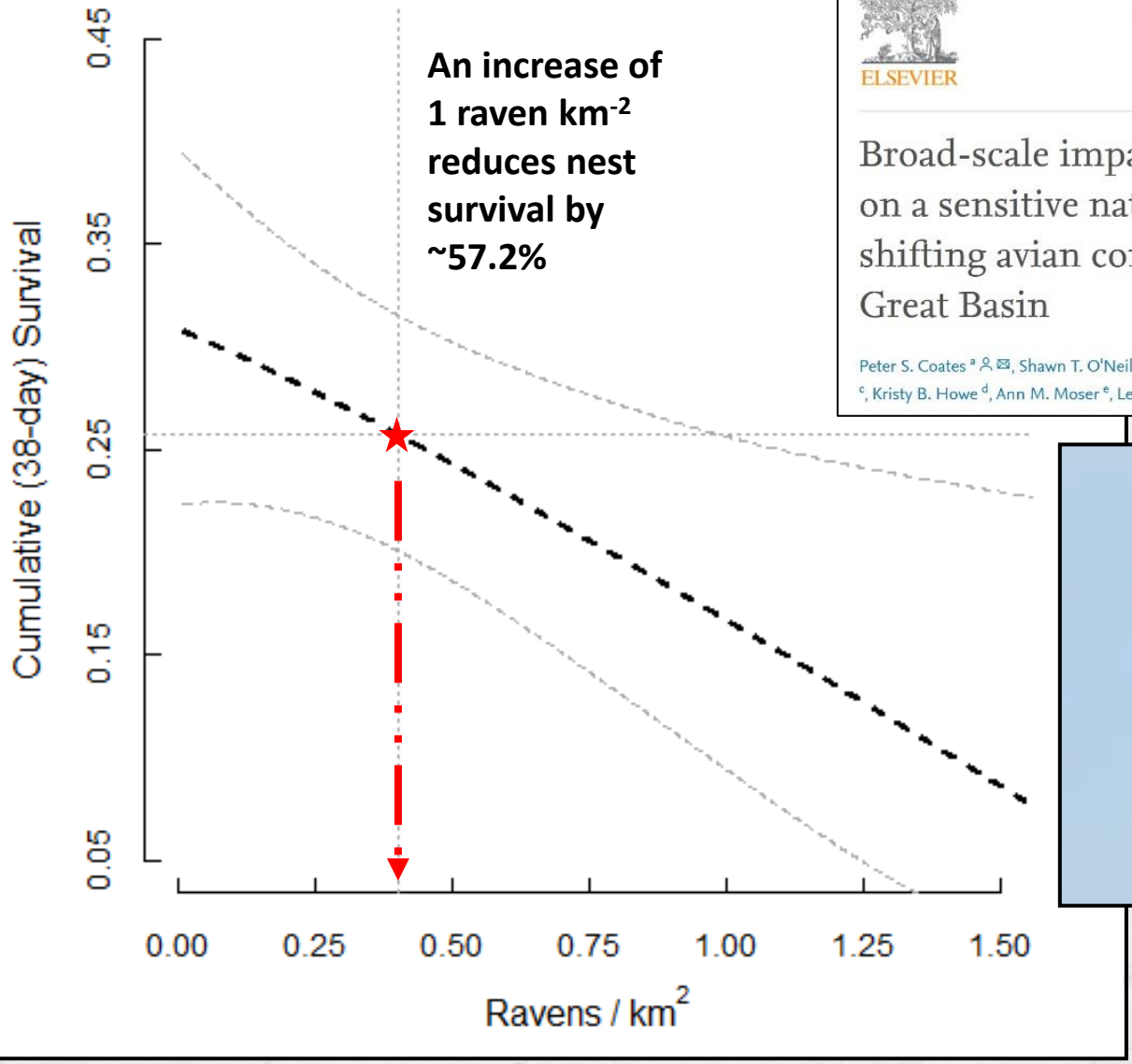


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Photo: BLM

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Photo: Matt La

Shrub cover influences predation by ravens

Journal of Wildlife Management 74(2):240–248; 2010; DOI: 10.2193/2009-047

Management and Conservation Article

Nest Predation of Greater Sage-Grouse in Relation to Microhabitat Factors and Predators

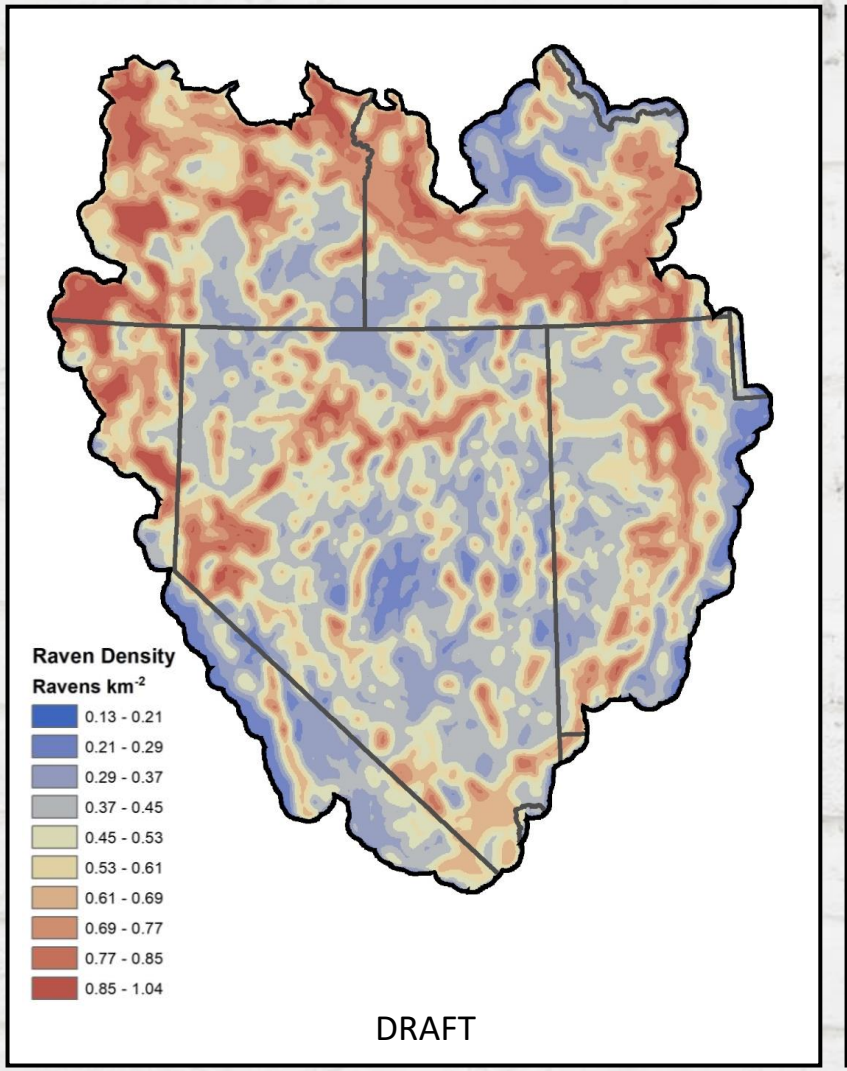
PETER S. COATES,[1] *Department of Biological Sciences, Idaho State University, Pocatello, ID 83209-8007, USA*
DAVID J. DELEHANTY, *Department of Biological Sciences, Idaho State University, Pocatello, ID 83209-8007, USA*

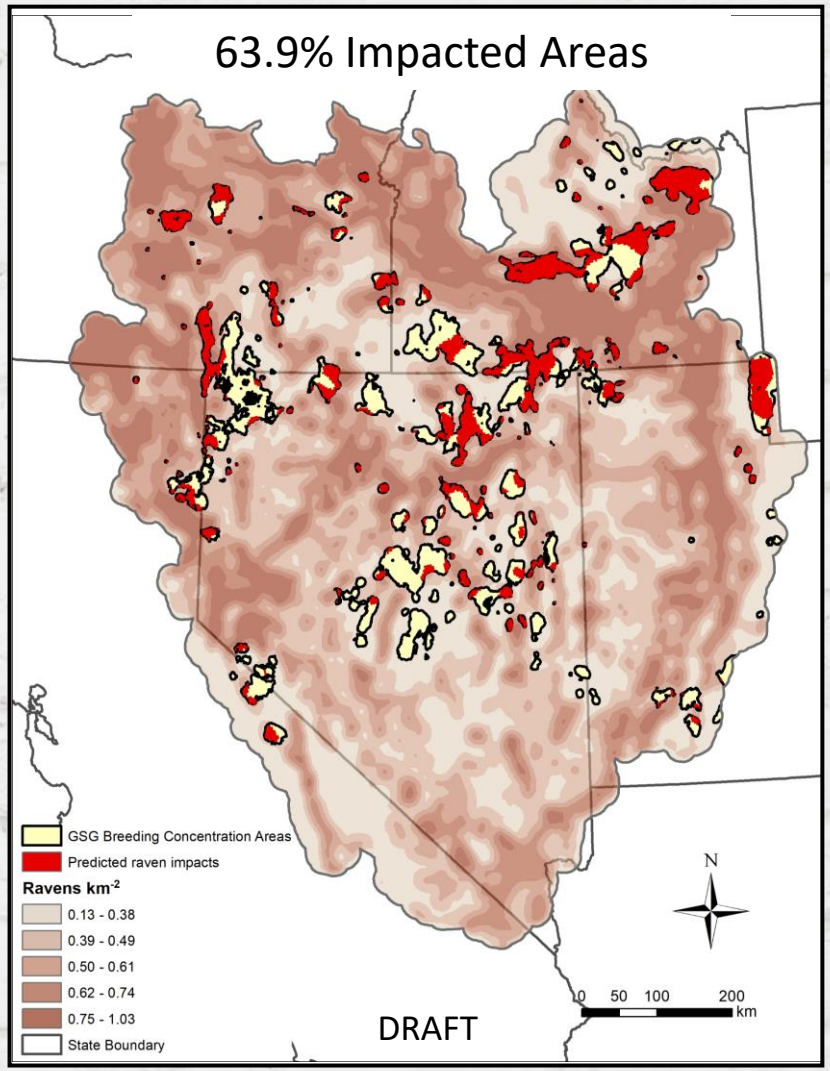
Resp.	Covariate	Estimate	95% CI lower	95% CI upper
Raven	raven	0.23	0.11	0.41*
	shrub cover	-0.08	-0.15	-0.02*
	grass	0.17	-0.63	0.41
	forb	0.16	-0.40	0.70
	understory	0.02	-0.04	0.08
	shrub height	0.00	-0.06	0.06
Badger	understory	0.10	0.03	0.12*
	forb	0.70	0.13	1.43*
	grass	0.23	-0.02	0.49
	shrub cover	0.02	-0.02	0.06
	shrub height	0.01	-0.01	0.42

1% decrease in shrub cover increased the odds of raven predation by 7.5%.

Raven occurrence increased with greater length of edge formed where big sagebrush and non-native vegetation met (e.g., fire scar).

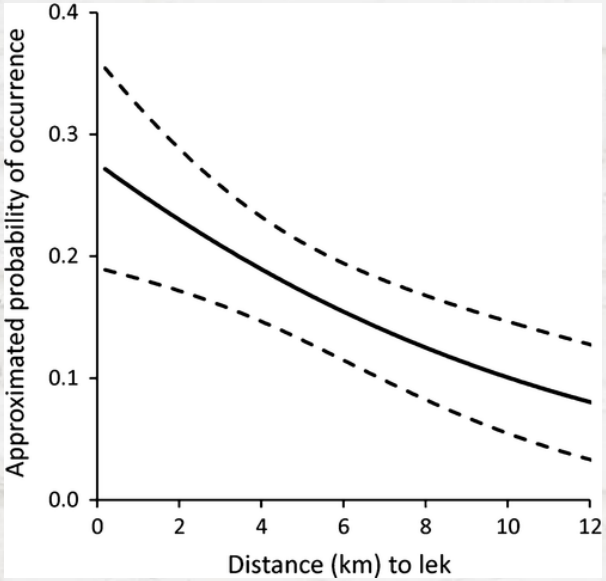
Broad scale impacts





Coates, O'Neil, Brussee et al. 2020. Biological Conservation

Impacts of ravens on lekking males



Coates et al. 2016

Raven attacks Gunnison sage-grouse (CO)

Overview

USGS science for a changing world

Problem

Expansion of raven distribution and abundance

↓

Anthropogenic resource subsidies

↓

Predation effects on sensitive species

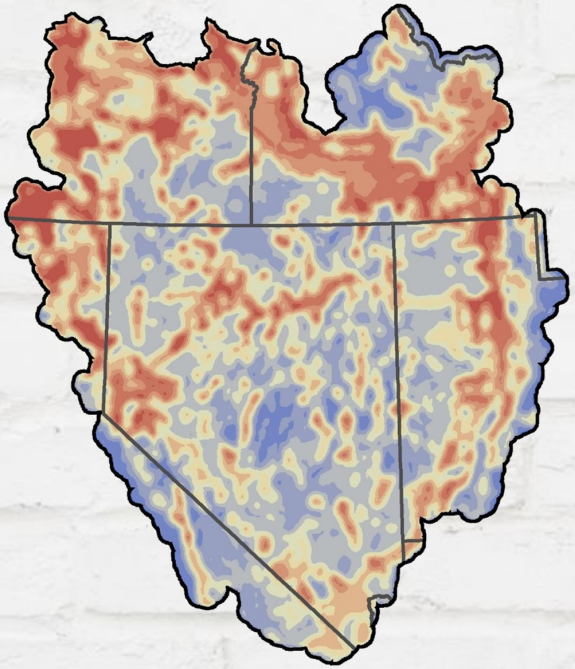
Solution

Science-based tiered framework

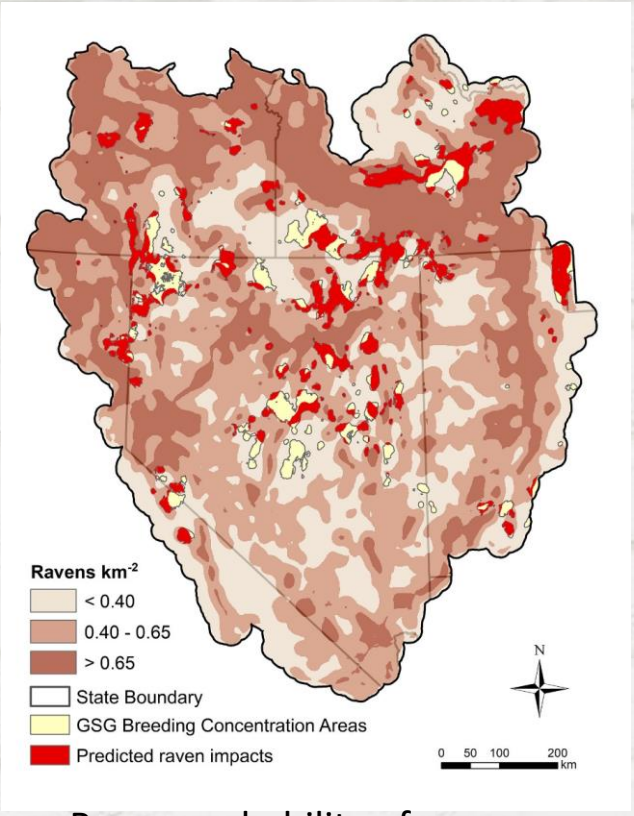
Science-based tiered framework

1. Identify priority areas (desktop analysis)
2. Estimate site-level raven densities
3. Compare estimate to ecological threshold
4. Provide management options
5. (Re)assess management action(s)

Step 1. Desktop analysis



- Raven probability of occurrence/density

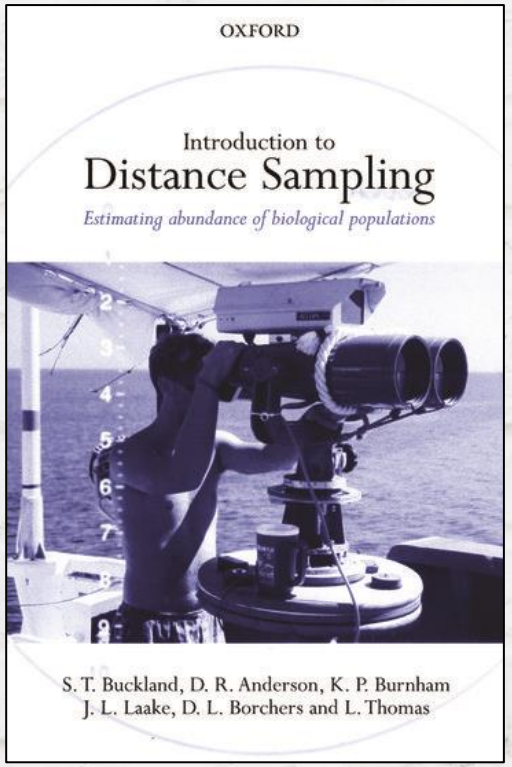


- Raven probability of occurrence & GRSG breeding habitat

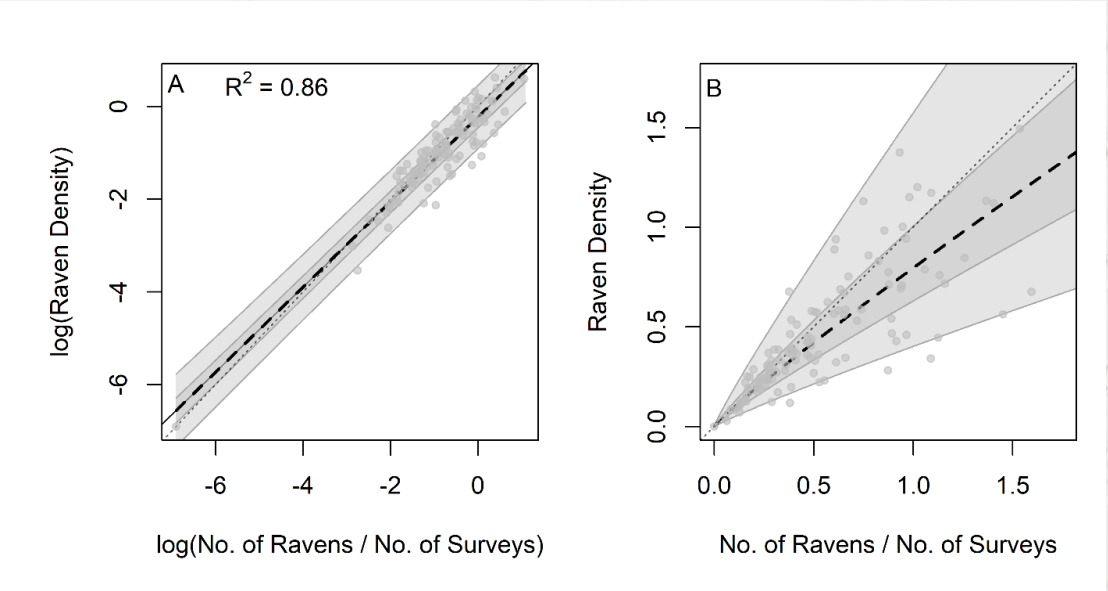
Coates et al. 2020. *Biological Conservation 243*. 10.1016/j.biocon.2020.108409

Step 2. Estimate site-level raven density

Distance sampling



Rapid assessment function



Brussee et al. 2021. A rapid assessment function to estimate common raven population densities: implications for targeted management. *Human–Wildlife Interactions*. 15(3)

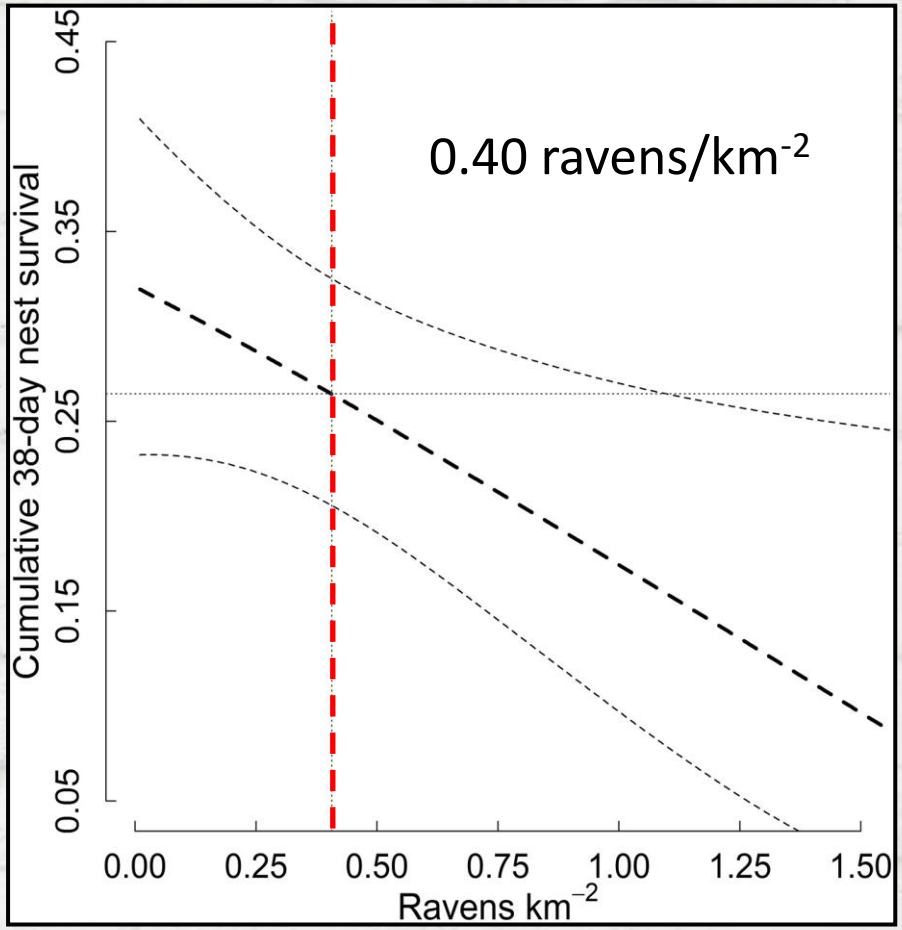
Step 3. Compare density estimate to threshold

ELSEVIER

Biological Conservation
Volume 243, March 2020, 108409

Broad-scale impacts of an invasive native predator on a sensitive native prey species within the shifting avian community of the North American Great Basin

Peter S. Coates [a], Shawn T. O'Neil [a], Brianne E. Brussee [a], Mark A. Ricca [a], Pat J. Jackson [b], Jonathan B. Dinkins [c], Kristy B. Howe [d], Ann M. Moser [e], Lee J. Foster [f], David J. Delehanty [g]



Step 4. Identify management options

The 3 Tiers

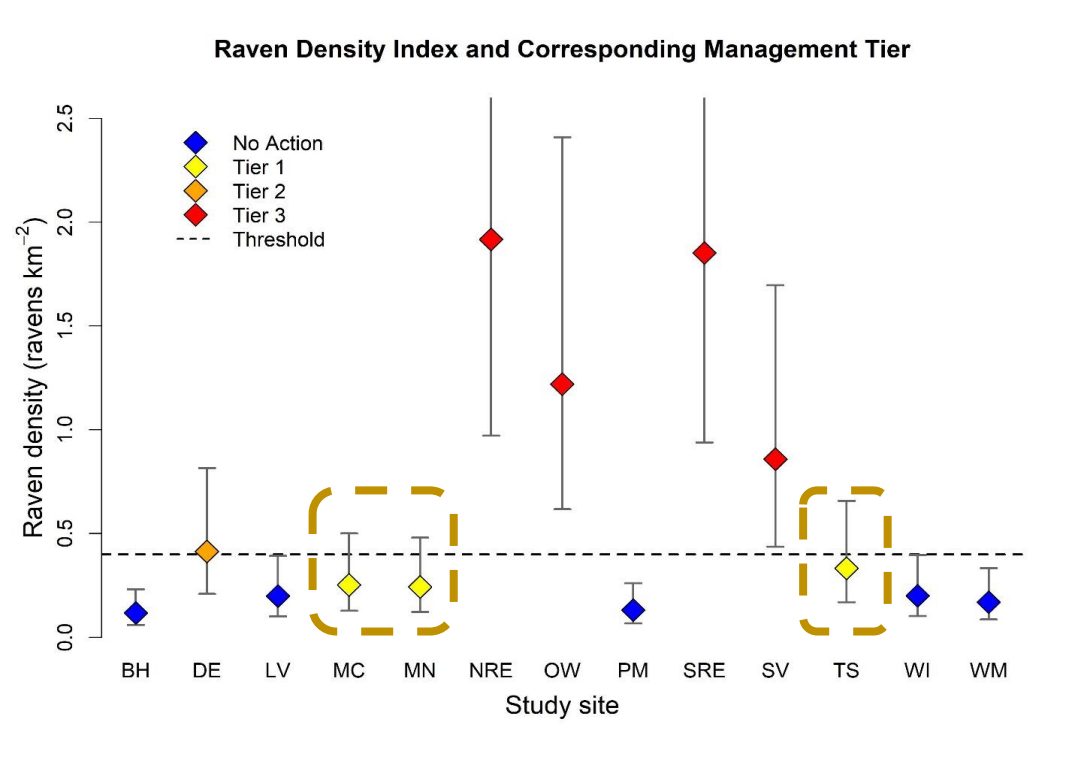
Tier	Trigger	Management Options
Tier 3	Density estimate – exceeds threshold 95% CI – exceeds threshold	Direct Action
Tier 2	Density estimate – exceeds threshold 95% CI – overlaps threshold	Reduce Access to Anthropogenic Subsidies
Tier 1	Density estimate – below threshold 95% CI – overlaps threshold	Habitat Improvement Actions
No Action	Density estimate - below threshold 95% CI – below threshold	

Dettenmaier SJ, PS Coates, CL Roth, SC Webster, ST O'Neil, JC Tull, and PJ Jackson. *In press*.
SMaRT: a science-based tiered framework for common raven management, *Human-Wildlife Interactions*.

Step 4. Identify management options

Tier 1

Density estimate – below threshold
95% CI – overlaps threshold

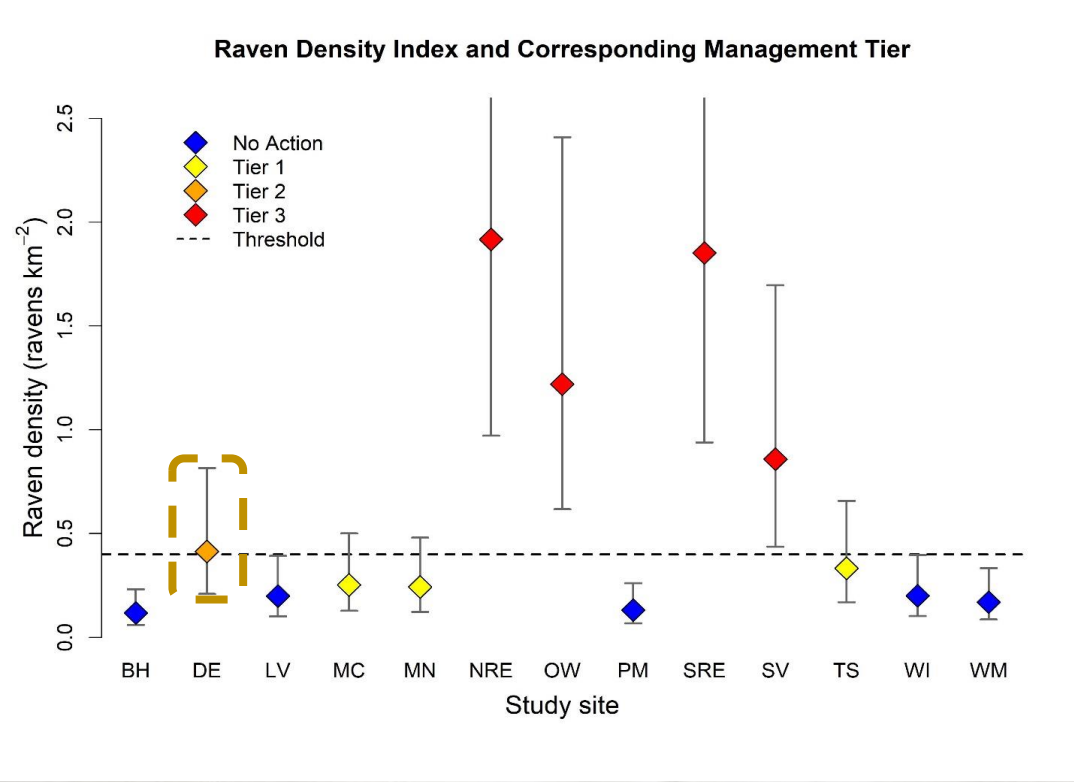


Dettenmaier SJ, PS Coates, CL Roth, SC Webster, ST O'Neil, JC Tull, and PJ Jackson. *In press*.
SMaRT: a science-based tiered framework for common raven management, *Human-Wildlife Interactions*.

Step 4. Identify management options

Tier 2

Density estimate – above threshold
95% CI – overlaps threshold

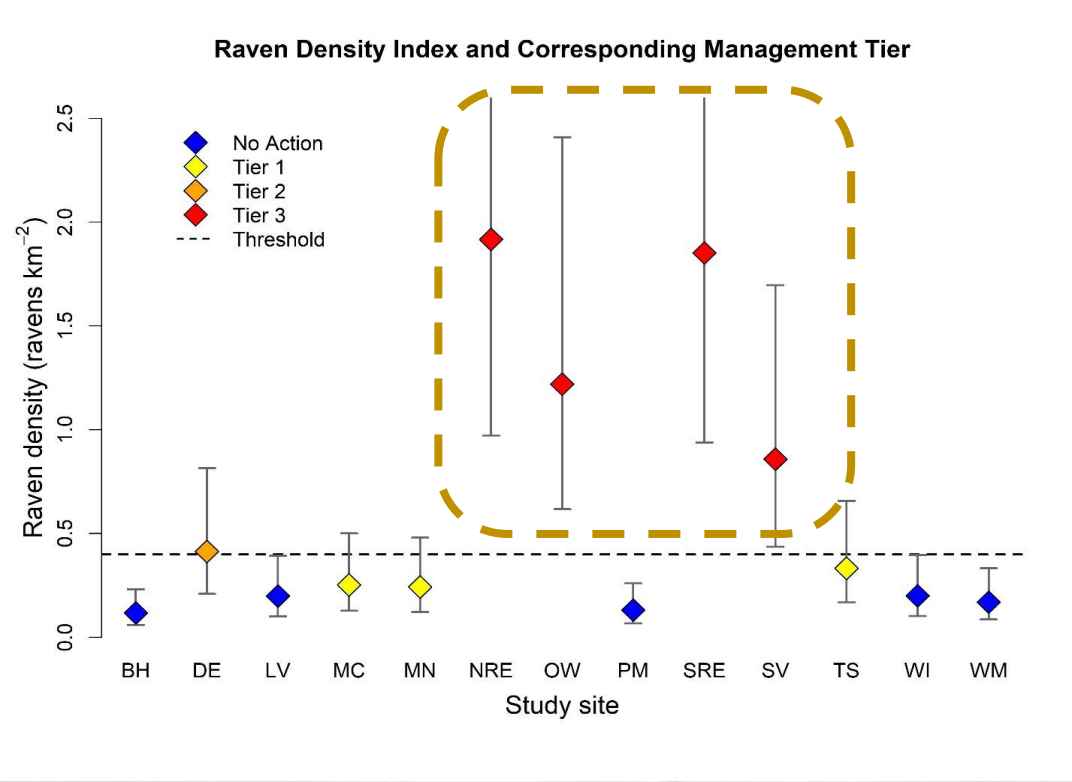


Dettenmaier SJ, PS Coates, CL Roth, SC Webster, ST O'Neil, JC Tull, and PJ Jackson. *In press*.
SMaRT: a science-based tiered framework for common raven management, *Human-Wildlife Interactions*.

Step 4. Identify management options

Tier 3

Density estimate – above threshold
95% CI – exceeds threshold

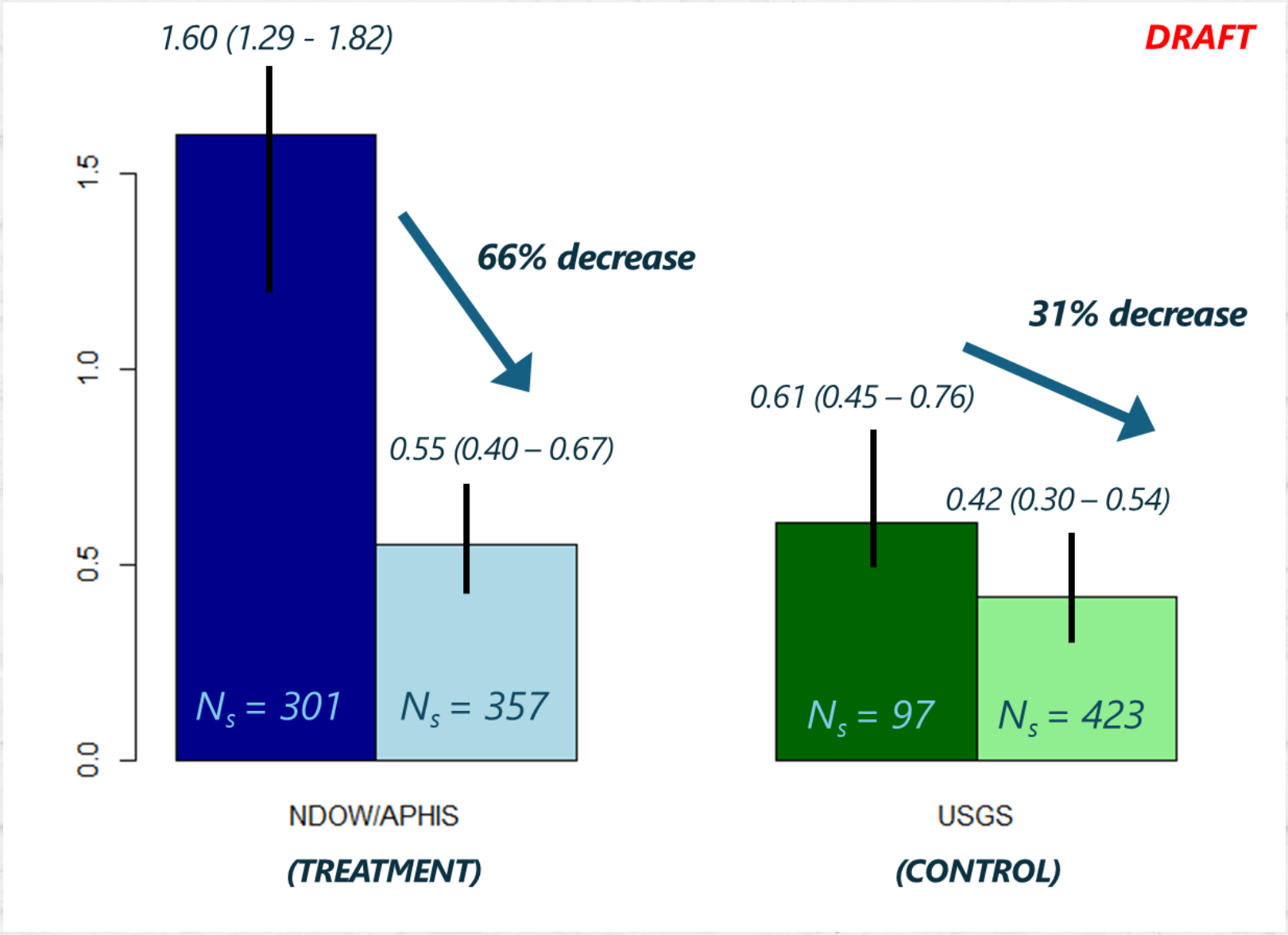


Dettenmaier SJ, PS Coates, CL Roth, SC Webster, ST O'Neil, JC Tull, and PJ Jackson. *In press*.
SMaRT: a science-based tiered framework for common raven management, *Human-Wildlife Interactions*.

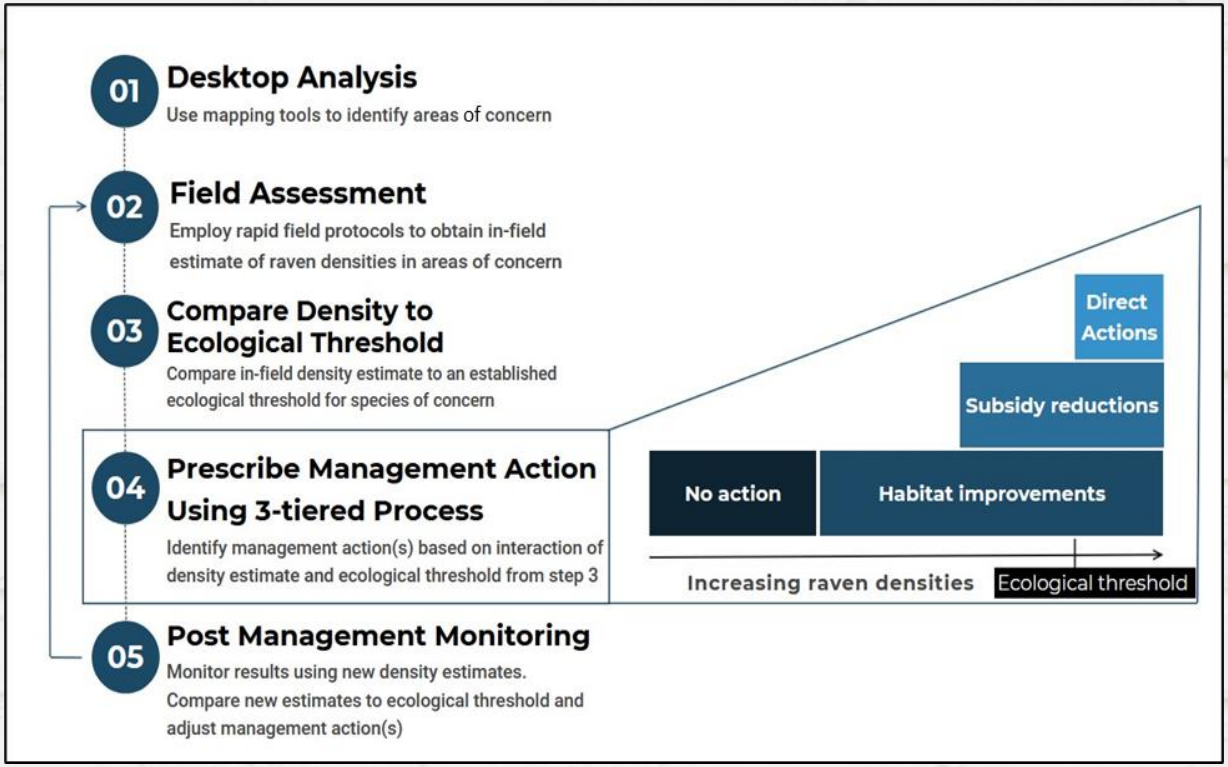
Step 4.5 Prioritizing the Priorities

- Used raven density estimate to score:
  - >0.40 = 1
  - >0.40 + std. deviation = 0.5
  - <0.40 + std. deviation = 0
- Alignment with Sage-grouse Concentration Area
  - True = 1
  - False = 0
- Tier Ranking
  - 3 = 1
  - 2 = 0.5
  - 1 = 0
- Nest Site Source or Sink
  - High = 1
  - Moderate = 0.5
  - Low = 0
- Total Score
  - 4-5 = HIGH
  - 3 = MODERATE
  - <3 = LOW

Step 5. Post-action monitoring


DRAFT
1.60 (1.29 - 1.82)
66% decrease
0.55 (0.40 – 0.67)
31% decrease
0.61 (0.45 – 0.76)
0.42 (0.30 – 0.54)
0.0
0.5
1.0
1.5
N_s = 301
N_s = 357
N_s = 97
N_s = 423
NDOW/APHIS
(TREATMENT)
USGS
(CONTROL)

From science-based framework to a decision support tool



Dettenmaier SJ, PS Coates, CL Roth, SC Webster, ST O'Neil, JC Tull, and PJ Jackson. *In press*. SMaRT: a science-based tiered framework for common raven management, *Human-Wildlife Interactions*.

SMaRT QR Code

https://www.usgs.gov/software/science-based-management-ravens-tool-smart

What's next?

1. Increase capacity to reach new permit limit
   a) Bandwidth
   b) Funding
2. Increase raven biology understanding
   a) Tier 2
   b) Tier 3
3. Collaborate with Biodiversity
4. Establish Common raven working group
5. Raise awareness